TRANSCRIPT OF RE

SUPREME COURT OF THE UNITED STA

OCTOBER TERM, 191

No. 179.

WESTINGHOUSE ELECTRIC AND MANUFACTURI
COMPANY, PETITIONER,

vs.

[illegible]INGER ELECTRIC AND MANUFACTURING COMPA

PETITION FOR CERTIORARI TO THE UNITED STATES CIRCUIT C
OF APPEALS FOR THE EIGHTH CIRCUIT.

PETITION FOR CERTIORARI FILED DECEMBER [illegible]
CERTIORARI AND RETURN FILED JANUARY [illegible]

(21,945.)

(21,945.)

SUPREME COURT OF THE UNITED STATES.

OCTOBER TERM, 1911.

No. 179.

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, PETITIONER,

vs.

WAGNER ELECTRIC AND MANUFACTURING COMPANY.

ON WRIT OF CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE EIGHTH CIRCUIT.

INDEX.

	Original.	Print
Caption	*a*	1
Stipulation to omit certain tabulations from printed record	*a*	1
Citation and acknowledgment of service	*c*	3
Transcript from the circuit court of the United States for the eastern district of Missouri	1	4
	1	4
Caption	1	4
Bill of complaint	8	8
Answer	16	13
Replication	18	14
Testimony for complainant	19	15
Stipulation as to certain facts	19	15
Deposition of Samuel Sheldon	29	21
Testimony for defendant	34	24
Deposition of Francis E. Nipher	36*a*	26
Exhibit 20—Sketch showing action of static transformer.		
Complainant's objection to certain of defendant's evidence	46	32
Exhibit 21—Sketch of Millar patent	48*a*	34

JUDD & DETWEILER (INC.), PRINTERS, WASHINGTON, D. C., AUGUST 22, 1911.

	Original.	Print
Deposition of George E. Wells	69	46
W. A. Layman	76	50
Francis E. Nipher (continued)	88	58
Exhibit 24 - Nipher sketch, transformer evolution	88*a*	58
Complainant's Exhibit Sketch—Nipher, X-Q. 10	90*a*	60
Deposition of W. A. Layman (continued)	107	70
Certificate to testimony of F. E. Nipher *et al*	127	82
Testimony for complainant in rebuttal	128	83
Deposition of C. R. Cross	128	83
V. S Beam	156	101
Complainant's exhibits	167	107
American Electrician, pages 12, 13, and 14	167	107
Wagner Co. Catalogue No. 102	171	111
Defendant's exhibits	179	119
2—Plaintiff's moving affidavits on preliminary injunction	179	119
Affidavit of Charles A. Terry	179	119
William J. Jenks	183	121
Benjamin B. Hull	194	128
Exhibit A—Letter to Herbert Wagner, Apr. 28, 1897	196	129
B—Letter, Wagner Electric Mfg. Co. to General Electric Co., May 13, 1897	197	129
C—Letter, George R. Blodgett to A. C. Fowler, July 13, 1897	198	130
Affidavit of Thomas P. Kerr	199	131
7 - Affidavit of W. A. Layman	204	134
3—Catalogue No. 102 of Wagner Electric Mfg. Co., Bulletin No. W-43	207	135
4—Opinion of Judge Amidon upon order to show cause why defendant should not be punished for contempt	219	147
23—Catalogue of Wagner Electric Mfg. Co., No. 101, Bulletin No. 9	223	149
Letters patent No. 366,362 to G. Westinghouse, Jr., July 12, 1887	244	170
No. 210,987 to D. Brooks, December 17, 1878	248	174
No. 266,290 to Hindley & Buffham, October 24, 1882	252	178
No. 269,036 to A. B. Fisher, Dec. 12, 1882	258	184
No. 270,457 to A. Millar, January 9, 1883	262	188
No. 271,169 to A. G. Waterhouse, January 23, 1883	268	194
No. 342,553 to G. Westinghouse, Jr., May 25, 1886	282	208
No. 349,617 to W. Stanley, Jr., Sept. 21, 1886	290	216
No. 349,616 to W. Stanley, Jr., Sept. 21, 1886	294	220
No. 552,105 to Zipernowsky, Deri & Blathy, November 2, 1886	298	224
No. 360,122 to E. Thomson, March 29, 1887	304	230
No. 349,612 to W. Stanley, Jr., Sept. 21, 1886	316	242
No. 428,574 to W. Stanley, Jr., May 20, 1890	320	246
No. 265,936 to E. Thomson, October 10, 1882	324	250
No. 366,347 to A. Schmid, July 12, 1887	330	256
Defendant's Exhibit 19—British letters patent No. 9728 to W. T. Thompson, August 19, 1887	335	261

	Original.	Print
Interlocutory decree, February 16, 1904	345	269
Report of special master	349	271
Record of proceedings before special master	403	302
Testimony for complainant	403	302
Testimony of Waldo A. Layman	403	302
Statement showing aggregate amount of defendant's business, etc., for the years 1896 to 1901	442	335
Stipulation as to opinion of United States court of appeals in case of Westinghouse Electric and Manufacturing Co. *vs.* Union Carbide Company	443	336
Testimony of Svend E. Johannesen	446	338
Theodore R. Foster	481	369
Complainant's Exhibit Layman Letter A, August 6, 1901	489	376
Complainant's Exhibit Schwedtmann Letter B, June 1, 1901	491	378
Complainant's Exhibit Layman Letter C, November 19, 1901	494	380
Defendant's motion that examiner find nominal damages only	499	385
Statement of complainant's counsel in closing proofs in chief on the accounting	500	386
Decision of the master on motion to find nominal damages only	508	392
Testimony for the defendant	519	402
Testimony of Francis E. Nipher	520	402
Thomas Gray	548	425
George E. Wells	568	442
Alexander S. Langsdorf	576	448
Waldo A. Layman	586	457
Table of size of transformers and prices thereof	604	472
Testimony of Ferdinand W. Schwedtmann	655	514
H. F. Sellinger	674	530
Record of orders for transformers, prices, etc	692	546
Defendant's exceptions to master's report	693	547
Decree on exceptions to master's report, December 24, 1907	698	552
Final decree, March 5, 1908	699	553
Order amending decree	704	557
Order allowing appeal	704	557
Assignment of errors	705	558
Petition for appeal	707	560
Bond on appeal	707	560
Præcipe for transcript	709	562
Additional præcipe for transcript	709	562
Opinion of the court on interlocutory decree	710	563
Opinion of the court on exceptions to report of master	718	570
Clerk's certificate to transcript	723	574
Supplemental transcript of record	724	575
Stipulation for supplemental transcript	724	576
Complainant's Exhibit A – Estimated manufacturing cost of standard transformers	727	576
B – Estimated manufacturing cost of standard transformers	729	576
Clerk's certificate to supplemental transcript	730	577

	Original.	Print
Clerk's certificate to printed record	731	577
Caption to supplemental transcript of proceedings in United States circuit court of appeals	732	578
Appearance of counsel for appellant	733	578
Appearance of Mr. A. C. Fowler as counsel for appellee	733	579
Appearance of Mr. Chester H. Krum as counsel for appellee	734	579
Argument commenced	734	579
Order of submission	735	580
Opinion of United States circuit court of appeals	737	581
Decree of United States circuit court of appeals	758	600
Petition of appellant for a rehearing	759	601
Order denying petition for a rehearing	823	653
Motion and affidavit for order staying mandate	823	654
Order staying mandate for sixty days from October 28, 1909	827	657
Clerk's certificate to supplemental transcript of proceedings	828	657
Stipulation as to return to writ of certiorari	829	658
Writ of certiorari	830	658
Return to writ of certiorari	832	659

a

CERTIFIED TRANSCRIPT OF RECORD.

United States Circuit Court of Appeals, Eighth Circuit.

No. 2857.

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY,
Appellant,
vs.
WAGNER ELECTRIC AND MANUFACTURING COMPANY, Appellee.

Appeal from the Circuit Court of the United States for the Eastern District of Missouri.

Filed May 21, 1908.

a' United States Circuit Court of Appeals, Eighth Circuit.

No. 2857. In Equity.

WESTINGHOUSE ELECTRIC & MANUFACTURING CO., Appellant,
vs.
WAGNER ELECTRIC MANUFACTURING CO., Appellee.

Stipulation.

In order to save the printing of "two volumes comprising the tabluations from the books of the defendant" taken before the Master and compiled under his directions, which two volumes are referred to towards the close of the Master's report in this case, which Master's report was filed in the United States Circuit Court on July 9, 1907, it is stipulated and agreed between counsel for appellant and counsel for the defendant:

That said two volumes of tabulations contain a list of more than six thousand transformers sold by the Wagner Electric Manufacturing Company, appellee, from and after June 24, 1896, up to and including November 14, 1901, being a list of transformers manufactured and sold by the Wagner Electric Manufacturing Company appellee and defendant, each of which transformers embodies in its construction the invention claimed by the fourth claim of the Westinghouse patent in suit No. 366,362, dated July 12, 1887, being infringing transformers manufactured and sold by the defendant, and which are the transformers referred to in the Master's report in this case, and concerning which transformers the Master in this case was ordered to take and state an account by the interlocutory decree entered in this cause by the Circuit Court on the 16th day of February, 1904. Said two volumes of tabulated statement of infringing transformers made and sold by the Wagner Electric Manufacturing Company from and after June 24, 1896, up to and

including November 14, 1901, which it is stipulated need not be printed as part of the record of the Court of Appeals in this case, is the tabulation from the defendant's books presented and filed before the Master on September 7, 1904, and is the same tabulation, record or report thereafter referred to by Waldo H. Layman, one of defendant's witnesses, in his testimony taken in this case. And that, as said defendant's witness, Waldo H. Layman, admits in questions and answers 84 and 85 of his testimony before the Master, said tabulated report or statement covers all transformers made and sold by the Wagner Electric Manufacturing Company from and after June 24, 1896, up to and including November 14, 1901, which transformers embody in their construction the invention claimed by claim 4 of the Westinghouse patent in suit, No. 366,362, dated July 12, 1887.

That said record or tabulated statement of infringing transformers in two volumes and referred to in last part of the Master's report, is made up of a list of defendant's infringing transformers covering the period specified above that is, between June 24, 1896, and November 14, 1901, containing the factory number of the order for each transformer, name of customer, residence of customer, date of sale, number of transformers in each sale to each customer, price of each transformer, total price to customer for each sale, and net price received.

That on the last page of said report is a tabulated statement concerning Union Carbide transformers referred to in the Master's report, which record shows that on December 7, 1898, the Wagner Electric Manufacturing Company, appellee, sold to the Union Carbide Company of Niagara Falls, New York, as order No. "A 2069," nine transformers, receiving for the same the sum of $15,460.00.

That in the following schedule given by appellee's witness, Waldo H. Layman, in answer to question 135 of his testimony before the Master, the figures under the heading "Proportion of business involved in the record of this inquiry" represent the amount received by the Wagner Electric Manufacturing Company, for the years 1896, 1897, 1898, 1899, 1900, 1901, beginning with June 24, 1896, and ending with November 14, 1901, for the infringing transformers listed in the said two books of tabulations from the books of the defendant company relating to infringing transformers manufactured and sold by Wagner Electric Manufacturing Company between June 24, 1896, and November 14, 1901:

"Year.	Total volume company's business.	Proportion of business involved in the record of this inquiry.	Total profits of the company on all kinds of apparatus.
1896.....	$238,122.35	$65,601.82	Profit.....$20,707.33
1897.....	226,096.46	128,244 12	Loss..... 21,743.38
1898.....	343,494.76	148,542.29	Profit..... ... 62,592.12
1899.....	411,337.74	235,335.78	Profit..... 58,382.67
1900.....	515,013.32	230,732.67	Loss 12,277 57
1901.....	580,710.10	146,815.08	Profit..... 40,318.90 "

c That the sum of the various amounts in the first column of the above tabulation is the $2,314,774.75 referred to by the Master at page 42 of his printed report as found in the transcript of this record; the sum of the various amounts in the second column of the above tabulation is the $955,274.76 referred to by the Master on said page of his report; and the arithmetical sum of the various amounts in the third column of the above tabulation is the $182,007.02 referred to by the Master on said page of his report.

July 23rd, 1908.

BAKEWELL & CORNWALL,
Solicitors for Westinghouse Electric & Manufacturing Company, Appellant.
A. C. FOWLER,
Solicitor for Wagner Electric Manufacturing Company, Appellee.

United States, C. C. A., Eighth Circuit. In Equity, No. 2857. Westinghouse Electric & Manufacturing Company vs. Wagner Electri Manufacturing Co. Stipulation to omit certain tabulations from the printed record. Filed Jul- 23, 1908. John D. Jordan, Clerk. Bakewell & Cornwall, Attorneys in Patent Causes. Chemical Bldg., St. Louis, Mo.

The United States of America to Wagner Electric and Manufacturing Company, Greeting:

You are hereby cited and admonished to be and appear in the United States Circuit Court of Appeals, Eighth Circuit, at St. Louis, Missouri, sixty days from and after the day this Citation bears date, pursuant to an appeal filed in the Clerk's office of the Circuit Court of the United States for the Eastern Division of the Eastern Judicial District of Missouri, wherein Westinghouse Electric and Manufacturing Company is appellant, and you are appellee, to show cause, if any there be, why the decree rendered against the said appellant as in said order allowing appeal mentioned, should not be corrected, and why speedy justice should not be done the parties in that behalf.

Witness the Honorable David P. Dyer, Judge of the Circuit Court of the United States for the Eastern District of Missouri, this 13th day of March in the year of our Lord one thousand nine hundred and eight.

DAVID P. DYER,
United States District Judge for the Eastern District of Missouri.

d Service of above citation hereby acknowledged this M'ch 13, 1908.

FOWLER & BRYSON,
Att'ys for Wagner Elec. Mfg. Co.

No. 4457. United States Circuit Court, Eastern Division of the Eastern Judicial District of Missouri. Westinghouse Electric and Manufacturing Co. vs. Wagner Electric Manufacturing Co. Citation. Filed 13 day of M'ch 1908. James R. Gray, Clerk.

1 UNITED STATES OF AMERICA,
Eastern Division of the Eastern
Judicial District of Missouri, ss:

Pleas and Proceedings Had in the United States Circuit Court for said Division of said District in Cause #4457, in Equity, Westinghouse Electric and Manufacturing Company, Complainant, versus Wagner Electric Manufacturing Company, Defendant.

(*Joint Printed Record.*)

United States Circuit Court, Eastern District of Missouri, Eastern Division.

In Equity. No. 4457.

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY,
Complainant,
vs.
WAGNER ELECTRIC MANUFACTURING COMPANY, Defendant.

Bill of Complaint.

Filed June 24, 1902.

To the Honorable the Judges of the Circuit Court of the United States for the Eastern District of Missouri:

The Westinghouse Electric and Manufacturing Company, a corporation organized and existing under the Laws of the State of Pennsylvania, and having its principal place of business at Pittsburg in the said State, brings this its bill of complaint against Wagner Electric Manufacturing Company, a corporation organized under the Laws of the State of Missouri and having its principal office and established place of business at the City of St. Louis in the said State, and the Eastern District thereof.

2 And thereupon your orator complains and says as follows:

1. That on the 27th day of December, 1886, George Westinghouse, Jr., a resident of Pittsburg, in the County of Allegheny and State of Pennsylvania, being the true, original and first inventor or discoverer of certain new and useful improvements in electrical converters, which were not known or used by others in this country, and were not patented or described in any printed publication in this or any foreign country before his invention or discovery thereof, and not abandoned by him, and not in public use or on sale for more than two years prior to the date of the application for the patent hereinafter mentioned, made application for letters patent of the United States in accordance with the then existing laws of Congress.

II. That after the requirements of the then existing laws of Congress had been duly complied with in all respects, letters patents of the United States, No. 366,362, signed, sealed and executed in due form of law, for the said invention and discovery, were granted to the said George Westinghouse, Jr., on the 12th day of July, 1887, whereby there was secured to the said George Westinghouse, Jr., and

to his heirs and assigns, for the term of seventeen years from said date, the full and exclusive right of making, using and vending the said improvements in electrical converters throughout the United States, as by said letters patent, or a duly certified copy thereof, in Court to be produced, will more fully and at large appear.

III. That by virtue of a certain assignment in writing dated the 7th day of June, 1896, duly executed, delivered and recorded in the United States Patent Office, all the right, title and interest in and to the said Letters Patent No. 366,362, and in and to the invention and improvements covered thereby, became vested in your
3 orator, as will be made to appear by the said assignment, or a duly certified copy thereof, in Court to be produced, as your Honors may direct.

IV. That the said Letters Patent No. 366,362, since the date of said assignment to your orator, have been and are now in the exclusive possession of your orator.

V. That the said patented invention has been extensively applied to practical use under the said patent, and is of great utility and benefit to the public and of profit to your orator; that your orator has notified the public that articles or apparatus made under the said patent are patented as aforesaid, by affixing thereto the word "Patented," together with the day and year the patent was granted; and that the public has recognized and acquiesced in the validity of said patent, the utility of said improvements, and your orator's exclusive right thereto; so that your orator has been, and, but for the infringement hereinafter complained of, would still be in undisturbed enjoyment of the exclusive privileges secured by said patent, and in receipt of the profits thereof.

VI. That on or about the 10th day of May, 1900, a bill of complaint was filed in the United States Circuit Court for the Northern District of New York by the complainant herein against Union Carbide Company, which said Union Carbide Co. was a user of electrical converters manufactured and sold by the Wagner Electric Manufacturing Company; that on or about the 15th day of June, 1900, the said cause against the Union Carbide Co. was certified and transferred to the Western District of New York, which Western District had, subsequently to the 10th day of May, and prior to the 15th day of June, 1900, been created by Act of Congress and duly organized; that on the 2d day of July, 1900, an answer to the said bill was duly filed by Union Carbide Company, and on or about the 6th day of August, 1900, complainant's replication was filed. That testimony was thereafter taken by the respective parties and filed in the Clerk's office of said United States Circuit Court for
4 the Western District of New York, and that thereafter and on or about the 24th day of May, 1901, the said cause came on for final hearing before the Honorable John R. Hazel, sitting as a Judge of the Circuit Court at Buffalo, within the said Western District, and was argued by counsel upon the pleadings and proofs; that on the 22d day of November, 1901, the decree was entered therein, in which it was adjudged, among other things, that Letters Patent of the United States No. 366,362, granted on July 12, 1887

(being the same letters patent hereinbefore referred to in this bill), are good and valid in the law; that the complainant, Westinghouse Electric and Manufacturing Company, is entitled to the exclusive right to the said letters patent and in and to the invention thereof, and that the defendant Union Carbide Company (using, as abovementioned, the electrical converters manufactured by Wagner Electric Manufacturing Company) had infringed upon the fourth claim of Letters Patent No. 366,362 and had violated the exclusive rights of the complainant thereunder.

That thereupon, to wit, on December 19, 1901, the Union Carbide Company appealed from the decree of the Circuit Court of the United States Circuit Court of Appeals for the Second Circuit, and, proper proceedings being had, the said appeal was argued before the said court of appeals composed of the Honorables William J. Wallace, E. Henry Lacombe and William K. Townsend, Circuit Judges, on the 27th day of February, 1902, and on April 29th, 1902, the said Court of Appeals filed an opinion affirming the decision of the Circuit Court with costs to your orator.

That the devices involved in the said suit, and which were used by the Union Carbide Company, the defendant therein, were manufactured and sold by the Wagner Electric Manufacturing Company, the defendant herein, and that said suit against the Union Carbide Company was defended by said Wagner Electric Manufacturing Company and was argued by its counsel, and that the matters and things found and decreed in the said suit against the Union Carbide Company are res adjudicata against the said Wagner Electric Manufacturing Company.

VII. That the said defendant has well known all the facts hereinbefore set forth, and has been duly notified of the grant and date of your orator's said patent and of its infringements thereof, but nevertheless, contriving to injure your orator and to deprive it of its profits, benefits and advantages which might and otherwise would have accrued to your orator from the said patent, the said defendant has, since the 12th day of July, 1887, and subsequent to the said assignment to your orator, within the Eastern District of Missouri and elsewhere throughout the United States, made, used and sold, and caused others to make, use and sell without the license of your orator, and against your orator's will and in violation of your orator's rights, and does now continue to make, use and sell, and to cause others to make, use and sell devices or apparatus which embody the invention or discovery claimed in your orator's said patent, the exclusive right to make, use and sell which is by law vested in your orator as aforesaid; and the said defendant refuses to pay to your orator any of the profits which it has made by such unlawful manufacture, use and sale, or to desist from the further infringement of said patent; all of which acts are in violation of the rights vested in your orator, and are contrary to equity and good conscience and tend to the manifest injury of your orator in the premises.

VIII. That the said defendant intends and threatens to continue such infringement and is prepared and ready so to do.

IX. Your orator therefore prays:

1. That the said defendant be required to make, according to the best and utmost of its knowledge, remembrance, information and belief, a full, true, direct and perfect answer (not, however, under oath, which is hereby expressly waived) to all the mat-
6 ters and things hereinbefore stated and charged, the same as if specifically interrogated as to each.

2. That a writ or writs of subpœna may issue directed to the said defendant, the Wagner Electric Manufacturing Company, commanding it to appear and answer unto this bill of complaint on a day certain therein to be named, and to abide and perform such order and decree in the premises as to this Court shall seem meet, and as may be required by the principles of equity and good conscience.

3. That the said defendant may be decreed to account for and pay to your orator the profits or income thus unlawfully derived from the violation of your orator's rights, and that upon the entering of the decree against the defendant for infringement your Honors may proceed to assess, or cause to be assessed, under your direction as well *as* the defendant's said unlawful profits or income, as also in addition thereto the damages sustained by your orator by reason of defendant's said infringement, and that your Honors may increase the actual damages so assessed to a sum equal to three times the amount of such assessment under the circumstances of the willful and unjust nature of the infringement.

4. That a writ of injunction may be issued from and under the seal of this Court perpetually enjoining and restraining the said defendant, the Wagner Electric Manufacturing Company, its clerks, attorneys, servants, agents, workmen and officers from any further manufacture, use or sale in any manner of said patented improvements or any part thereof, in violation of your orator's rights; and that the infringing devices in possession or use of the defendant may be decreed to be destroyed or delivered to your orator for that purpose.

5. That a provisional or preliminary injunction be issued, restraining the said defendant, its attorneys, agents, clerks, servants, workmen and officers from any further manufacture, use or sale in any manner of said patented improvements or any part thereof pending this cause.

7 6. That such other and further relief may be granted and decreed to your orator as the equity of the case may require and to your Honors may seem meet.

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY,
By G. W. HEBARD,
Acting Vice-President.

____ ____,
Solicitors for Complainant.
THOMAS B. KERR,
DRURY W. COOPER,
Of Counsel.

STATE OF NEW YORK,
County of New York, ss:

George W. Hebard, being duly sworn, deposes and says:

I am acting vice-president of the Westinghouse Electric and Manufacturing Company, the complainant corporation mentioned in the foregoing bill of complaint. I have read the foregoing bill of complaint, and of my own knowledge know it to be true, except as to the matters therein stated to be alleged upon information and belief, and as to those matters I believe it to be true.

Furthermore, I verily believe the said George Westinghouse, Jr., in the said bill named, to be the first, original and sole inventor of the said inventions described and patented in the said letters patent on his application, as alleged in the bill.

GEORGE W. HEBARD.

Subscribed to and sworn to before me this 17th day of June, 1902.

M. LAWSON DYER,
Notary Public (68), *N. Y. Co., N. Y.*

8 United States Circuit Court, Eastern District of Missouri, Eastern Division.

In Equity. No. 4457.

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, Complainant,
vs.
WAGNER ELECTRIC MANUFACTURING COMPANY, Defendant.

Answer.

[Filed October 6, 1902.]

The Answer of the Wagner Electric Manufacturing Company, Defendant, to the Bill of Complaint of Westinghouse Electric and Manufacturing Company, Complainant.

The defendant now and at all times hereafter, saving to itself all and all manner of benefit and advantage of exception or otherwise that can or may be had or taken to the many errors, uncertainties and imperfections in said bill contained, for answer thereunto, or to so much thereof, as this defendant is advised it is material and necessary for it to make answer to, answering says:

I.

This defendant admits that the Westinghouse Electric and Manufacturing Company is a corporation organized and existing under the laws of the State of Pennsylvania, and having its principal

place of business in Pittsburgh, in said State, and that the Wagner Electric Manufacturing Company is a corporation organized under the laws of the State of Missouri, and having its principal office and established place of business at the City of St. Louis, in said State and in the Eastern District thereof.

II.

This defendant denies upon information and belief that George Westinghouse, Jr., was on the 27th day of December, 1886, the true, original and first inventor or discoverer of the alleged new and useful improvements in electrical converters mentioned in said bill of complaint; and it likewise denies that said alleged improvements were not known or used by others in this country and were not patented or described in any printed publication in this or any foreign country before the said Westinghouse's alleged invention or discovery thereof, and not abandoned by him and not in public use or on sale for more than two years prior to the date of the application for the letters patent mentioned in said bill of complaint.

III.

This defendant further answering admits that said George Westinghouse, Jr., made application for letters patent of the United States for said alleged improvements, but denies upon information and belief that said application was made in accordance with the then existing laws of Congress, or that the said laws of Congress were duly complied with in all respects. But this defendant admits that an instrument in writing purporting to be Letters Patent of the United States No. 366,362 and to be signed, sealed and executed in due form of law, was issued to the said George Westinghouse, Jr., for said alleged invention of discovery on the 12th day of July, 1887; but this defendant denies upon information and belief that there was secured to said George Westinghouse, Jr., by said alleged letters patent, and to his heirs and assigns for the term of seventeen (17) years from said date, the full and exclusive right of making, using and selling the said electrical converters throughout the United States.

IV.

This defendant admits that by virtue of a certain instrument in writing, dated the 7th day of June, 1896, and duly executed, delivered and recorded in the United States Patent Office, all the right, title and interest in and to the said alleged Letters Patent No. 366,362 became vested in the complainant, and they say that they have no information other than that in said bill of complaint contained, whether or not since the date of said assignment, the said letters patent have been and now are in the exclusive possession of the complainant, and they, therefore, require strict proof thereof.

V.

This defendant, further answering, denies, upon information and belief, that the said patented invention has been extensively

applied to practical use under the said patent, and is of great utility and benefit to the public, and of profit to the complainant; and it further denies, upon information and belief, that the complainant has notified the public that articles or apparatus made under said alleged patent are patented by affixing thereto the word "Patented," together with the day and year said alleged patent was granted; and it further denies that the public has recognized and acquiesced in the validity of said patent, the utility of said improvements and the complainant's exclusive right thereto; and it further denies
11 that the complainant has been, and but for the alleged infringement complained of in said bill of complaint, would still be in undisturbed enjoyment of the exclusive privileges purporting to be secured by said letters patent, and in receipt of the profits thereof.

VI.

This defendant admits that on or about the 10th day of May, 1900, a bill of complaint was filed in the United States Circuit Court for the Northern District of New York, by the complainant in this suit, against the Union Carbide Co., which said Union Carbide Company was a user of electrical converters manufactured and sold by this defendant; that on or about the 15th day of June 1900, the said cause against the Union Carbide Company was certified and transferred to the Western District of New York; that on the 2d day of July, 1900, an answer was filed in said suit by the Union Carbide Company, and on or about the 6th day of August, 1900, replication was filed; that testimony was thereafter taken by the respective parties and filed in the Clerk's office of the United States Circuit Court for the Western District of New York, and that thereafter and on or about the 24th day of May, 1900, said cause came on for final hearing before the Honorable John R. Hazel, sitting as Judge of the Circuit Court at Buffalo within the said Western District, and was argued by counsel upon the pleadings and proofs; that on the 22d day of November, 1901, a decree was entered therein, in which it adjudged that the fourth claim of said United States Letters Patent No. 366,362 of July 12, 1887, was a good and valid claim in the law; that the complainant herein was entitled to the exclusive right to said letters patent and in and to the inventions described and claimed in claim 4 thereof; that the Union Carbide Company had infringed upon the said fourth claim of said letters patent and had violated the exclusive rights of the complainant under said fourth claim. But this defendant denies that by the said
12 decree it was adjudged that any of the other claims of said Letters Patent No. 366,362 were good and valid in the law, or that the complainant was entitled to the exclusive right in and to the invention claimed in any of the other claims of said letters patent; and this defendant further denies that the Union Carbide Co. was adjudged by said decree to have infringed upon any other claim of said Letters Patent No. 366,362. And this defendant alleges that after the filing of the said bill of complaint against the said Union Carbide Company, as above set forth, and before the said final

hearing before the Honorable John R. Hazel, above mentioned, claims 1, 2, 3 and 5, being all of the remaining claims of said Letters Patent No. 366,362, were withdrawn by the complainant from the consideration of the Court and were not included in said decree.

VII.

This defendant further answering admits that on the 19th day of December, 1901, the said Union Carbide Company appealed from said decree of the Circuit Court to the United States Circuit Court of Appeals for the Second Circuit and that proper proceedings were held, and that said appeal was argued before the said Court of Appeals, composed of the Honorables William J. Wallace, E. Henry Lacombe and William K. Townsend, Circuit Judges, on the 27th day of February, 1902, and that on April 29, 1902, the said Court of Appeals filed an opinion affirming the decision of the Circuit Court with costs to the complainant.

VIII.

This defendant admits that the device involved in said suit and used by the Union Carbide Company, the defendant therein, was manufactured and sold by this defendant, and that said suit against the said Union Carbide Company was defended by this de-
13 fendant and was argued by its counsel, and that the matters and things found and decreed in said suit against the Union Carbide Company are res adjudicatæ against this defendant.

IX.

This defendant admits that it has been duly notified of the grant and date of said alleged letters patent and of its alleged infringement thereof, but it denies that it has contrived to injure the complainant, and to deprive it of the profits and benefits which would have accrued to it from said patent. And this defendant admits that it has, since the 12th day of July, 1887, and subsequent to the assignment to the complainant, within the Eastern District of Missouri and elsewhere throughout the United States, made, used and sold devices or apparatus which embody the invention or discovery claimed in claim 4 of said letters patent; but this defendant denies that it has, since the 12th day of July, 1887, and subsequent to said assignment to the complainant, made, used and sold within the United States or its Territories, without the license of the complainant and against the complainant's will, and in violation of the complainant's rights, or that it now continues to make, use and sell within the United States or its Territories, and to cause others to make, use and sell within the United States or its Territories, devices or apparatus which embody the alleged invention or discovery claimed in claims 1, 2, 3 and 5 of the complainant's said letters patent. And this defendant denies that it refuses to pay to the complainant any of the alleged profits which it may have made by said alleged unlawful manufacture, use and sale, or to desist from further infringement of said patent.

14 X.

This defendant denies that it intends and threatens to continue such alleged infringement, or is prepared and ready so to do.

XI.

And this defendant further says that any recovery by the plaintiff herein of profits or damges for any alleged infringement committed by this defendant prior to June 24th, 1896, is barred by Section 4921 of the Revised Statutes of the United States as amended by Section 6 of a statute passed by the Fifty-fourth Congress and entitled "An Act Revising and Amending the Statutes Relating to Patents," and approved March 3, 1897, and to be found in volume 29 of the United States Statutes at Large, chapter 391, pages, 692, 693 and 694.

XII.

The defendant, further answering herein, says that prior to any invention by the said George Westinghouse, Jr., of the said alleged invention or improvements claimed in claims 1, 2, 3 and 5 of said letters patent, the same, or substantial and material parts thereof, were set forth and described in and by the hereinafter mentioned letters patent and printed publications, and by other letters patent and printed publications not now known to this defendant, but which this defendant prays leave to insert in its answer by way of amendment, when known to it, the said letters patent and printed publications now known to this defendant being as follows:

United States Patents.

Brooks, No. 210,987, December 12, 1878.
Hindley & Buffham, No. 266,290, October 24, 1882.
15 Fisher, No. 269,036, December 12, 1882.
Miller, No. 270,457, January 9, 1883.
Waterhouse, No. 271,169, January 23, 1883.
Westinghouse, No. 342,553, May 25, 1886.
Stanley, No. 349,616, September 21, 1886.
Stanley, No. 349,617, September 21, 1886.
Zipernowsky, Deri & Blathy, No. 352,105, November 2, 1886.
Thomson, No. 360,122, May 29, 1887.
Schmid, No. 366,347, July 12, 1887.
Thomson, No. 428,648, May 27, 1890.
De Ferranti, No. 435,114, August 26, 1890.
Weston, No. 233,823, October 26, 1880.
Nungesser, No. 287,773, October 30, 1883.
Parsons, No. 344,542, June 29, 1886.
Stanley, No. 349,612, September 21, 1886.
Stanley, No. 428,574, May 20, 1890.

British Patents.

No. 14,233, 1884.
No. 15,141, December 9, 1885.
No. 15,251, December 11, 1885.
No. 4,302, 1884.

French Patent.

No. 180,176, December 9, 1886.

Printed Publication.

"L'Appareil d'Induction Electrique de Ruhmkopff," by Du Moncel, 1867, page 30.

XIII.

The defendant further answering herein, says that the said George Westinghouse, Jr., surreptitiously or unjustly obtained said patent for that which was in fact invented by Sebastian Z. de Ferranti, of London, England, who was using reasonable diligence in adapting and perfecting the same.

16

All of which defenses this defendant is ready to maintain and prove as this Honorable Court shall direct, and it prays hence to be dismissed, with its costs in this behalf sustained.

WAGNER ELECTRIC MANUFACTURING CO.,

[SEAL.] By S. M. DODD, *Its President.*

Attest:

S. B. PIKE,
Secretary.

FOWLER & BRYSON,
Solicitors and of Counsel for Defendant.

United States Circuit Court, Eastern District of Missouri.

In Equity. No. 4457.

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY
vs.
WAGNER ELECTRIC MANUFACTURING COMPANY.

Replication.

[Filed November 3, 1902.]

The Replication of the Above-Named Complainant to the Answer of the Above-Named Defendant.

This replicant, saving and reserving to itself all and all manner of advantage of exception which may be had and taken to the manifold errors, uncertainties and insufficiencies of the answer of said defendant, for replication thereunto saith that it does and will ever maintain and prove its said bill to be true, certain and sufficient in the law to be answered unto by said defendant, and that the answer of said defendant is very uncertain, evasive and insufficient in the law to be replied unto by this repliant;

17

without that, that any other matter or thing in the said answer contained material or effectual in the law to be replied unto, confessed or avoided, traversed or denied, is true; all which matters and things this repliant is ready to aver, maintain and prove as this Honorable Court shall direct, and humbly prays as in and by its said bill it has already prayed.

New York, November 3d, 1902.

KERR, PAGE & COOPER,
Solicitors for Complainant.

18 United States Circuit Court, Western District of Missouri, Eastern Division.

In Equity.

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, Complainant,
vs.
WAGNER ELECTRIC MANUFACTURING COMPANY, Defendant.

Complainant's Prima Facie Testimony.

Evidence taken on behalf of complainant, for final hearing, de bene esse, before Benjamin Barker, Standing Examiner of the United States Circuit Court for the Southern District of New York, commencing, pursuant to the annexed notice, at the office of Kerr, Page & Cooper, No. 149 Broadway, New York City, on the 2d day of June, 1903, at 11 o'clock in the forenoon.

Present:

Drury W. Cooper, Esq., counsel for complainant. No appearance for defendant.

Complainant's counsel states that by agreement of counsel the right of cross-examination and of objection is reserved to the defendant's counsel.

Counsel for both parties stipulate that printed Patent Office copies of United States Letters Patent and official Blue Book copies of British Letters Patent may be used by either side with the same force and effect as though duly certified.

Complainant's counsel offers in evidence a printed Patent Office copy of United States Letters Patent No. 366,362, dated July 12, 1887, to George Westinghouse, Jr., for an electrical converter, and the same is marked "Complainant's Exhibit Patent in Suit, B. B., Ex'r."

19 It is hereby stipulated for the purposes of this suit by counsel for the respective parties as follows:

First. That the defendant prior to the filing of the bill of complaint herein, did manufacture and sell electrical transformers constructed and intended to be used as shown and described in figure 24

of an article which appeared in the issue of the "American Electrician" for January, 1900, on page 13 thereof, said illustration showing a transformer having parallel primary and secondary coils and a core composed of thin plates of soft iron arranged in groups, said groups being separated from each other by blocks, thus providing spaces between the groups of plates; and the coils and core being enclosed in a metal case containing a non-conducting fluid which circulates through the open spaces in the laminated core.

Second. That the defendant, prior to the filing of the bill of complaint herein, did manufacture and sell electrical transformers such as are described and illustrated in the printed pamphlet entitled "Wagner Electric M'f'g. Co. St. Louis, U. S. A., Catalogue No. 102, Bulletin No. 59, 1903."

Complainant's counsel offers in evidence, pages 12, 13 and 14 of the "American Electrician" for January 1900, which is referred to in the foregoing stipulation, and the same is marked "Complainant's Exhiibt American Electrician Article, B. B., Ex'r."

Complainant's counsel offers in evidence the Wagner Electric M'f'g Co. Catalogue No. 102, Bulletin No. 159, which is referred to in the foregoing stipulation, and the same is marked "Complainant's Exhibit Wagner Co. Catalogue, B. B., Ex'r."

Deposition of Samuel Sheldon.

SAMUEL SHELDON, a witness produced on behalf of the complainant, having been first duly sworn, deposes as follows in answer to interrogatories by Mr. COOPER:

20 1 Q. Please state your name, age, residence and occupation?

A. Samuel Sheldon; age, forty-one; residence, Brooklyn, N. Y.; occupation, Professor of Physics and Electrical Engineering and Consulting Engineer.

2 Q. Please state what experience you have had to qualify you to testify as an expert with relation to electrical apparatus generally, and particularly with relation to the subject matter of this suit—to wit, electrical transformers or converters?

A. I graduated from Middlebury College in 1883 with the degree of Bachelor of Arts. I was instructor in that college during the academic years 1884 and 1885. I was assistant in physics at the University of Wuerzburg, Germany, during the academic years 1886, 1887, at which place I received the degree of Ph. D., and I was assistant in physics at Harvard University during the academic year 1887-1888, and I was then called to the chair of Physics and Electrical Engineering at the Polytechnic Institute of Brooklyn, N. Y., and I have held that position continuously ever since. I am a member of the American Institute of Electrical Engineers, and one of its Vice-Presidents. I am a Fellow of the American Association for the Advancement of Science, a Fellow of the American Electrotherapeutic Association; a member of the American Physical Society, and am President of the New York Electrical Society. I am

author of many scientific and electrical papers which have appeared from time to time in the technical press and the printed proceedings of the scientific societies. I am joint author of the book entitled "Alternating Current Machines" in which the subject of transformers is treated both from the theoretical and practical standpoint. During my connection with the Polytechnic Institute I have carried on a practice as a consulting electrical engineer, and have frequently been called upon to give evidence in patent litigation. I am familiar with the construction and use of electrical transformers or converters.

21 3 Q. Have you read Letters Patent No. 366,362, issued on July 12, 1887, to George Westinghouse, Jr., for an electrical converter, and do you understand the same?

A. I have read the patent in question, and believe that I understand it.

4 Q. Have you considered the transformers manufactured and sold by the defendant herein, as illustrated and described in "Complainant's Exhibit American Electrician Article" and in "Complainant's Exhibit Wagner Co. Catalogue," and the stipulations covering the same; if you have, please compare these structures with the invention or improvements set forth in Letters Patent 366,362 and claimed in the fourth claim thereof?

A. I have considered the defendant's structures as set forth in the question, and believe that I understand them. I will proceed to compare them with the fourth claim of the patent in suit:

The patent in suit, as stated in the specification, "relates to the construction of a class of apparatus employed for transforming alternating or intermittent electric currents of any required character into currents differing therefrom in certain characteristics, such apparatus are usually termed 'induction coils' or 'converters.'" These devices are at present almost universally called transformers. They are sometimes called static transformers, the word static being used to convey the idea that there are no essential parts which move or rotate when the apparatus is in operation. In its simplest form the transformer consists of two coils of insulated wire wound upon an iron core, which is common to both coils. When in operation electrical energy is received by one of the coils in the form of an alternating current which flows through it. This current produces in the iron core a magnetic flux which alternates its direction of polarity with the same frequency as the alternations in the direction of flow of the current. This changing magnetic flux in turn

22 gives rise to an alternating electro-motive force in the second coil. If the second coil be connected to a circuit outside the transformer, current will flow in this circuit. The energy which is received by the first coil is passed over by the magnetic core to the second coil. The particular value of the transformer depends upon the fact that the voltage at which electrical energy is received by one coil can be made to bear any desirable ratio to the voltage of the electrical energy sent out by the other coil simply by a proper adjustment of the ratio in the number of turns of wire in the two coils. Transformers are of great utility in the long-distance transmission

of power by means of electricity. Economy dictates that transmission shall take place at high voltages. Consideration for personal safety, fire hazard, and commutation difficulties in converters demands that utilization of the transmitted power should be at low voltages. Transformers accomplish this change of voltage between transmission lines and service circuits in a very efficient, economical and satisfactory manner.

The object of the invention of the patent in suit is described in the words of the specification as follows:

"The object of this invention is to provide a simple and efficient converter which will not become overheated when employed for a long time in transforming currents of high electro-motive force, and which will be thoroughly ventilated."

Not all of the energy which is received at the terminals of one coil of a transformer is given out at the terminals of the other coil. The transformation is accompanied by losses. The lost energy is consumed (*a*) in sending the currents through the coils against their resistances, (*b*) in setting up eddy currents in the core and to a slight extent in the coils, and (*c*) in carrying the core through its cycles of magnetization. The last loss is termed hysteresis loss. These losses appear in the form of heat, and are evidenced by a rise in temperature in the coils and core. When there is continuous operation under given conditions, the rise will continue until such a temperature is reached that the rate of escape of heat from the surfaces of the core and of the coils, by radiation, convection, and conduction, to the surrounding air and objects, is equal to the rate of production of heat owing to the losses.

The common insulating materials used in transformers deteriorates very rapidly when subjected to a temperature of 100 degrees centigrade. It is, therefore, essential that transformers should not be allowed to assume such a high temperature. The magnitude of the losses due to the resistance of the coils is increased under the same loads with an increase of temperature. In many transformers it has been observed that the hysteresis losses have increased with time. The character of the iron has been modified and is said to have aged. There is a general belief that aging is related to or caused by a sustained elevation in the temperature of the iron. Good practice does not permit of a temperature higher than 75 degrees centigrade. Small-sized transformers can be kept, when in operation, at a lower temperature than this, without employing any special methods of construction. As the dimensions of a transformer are increased, however, the capacity and the energy losses increase more rapidly than the surfaces of the coils and of the core. The amount of heat which must escape from each unit of surface in a unit's time is, therefore, increased and a greater elevation of temperature results. The temperature elevation in a given case is much lessened by the form of construction indicated in the specification of the patent in suit. That form of construction which is germane to this suit is indicated in the fourth claim of the patent, which reads as follows:

"4. The combination, substantially as described, of an electric

converter constructed with open spaces in its core, an enclosing case, and a non-conducting fluid or gas in said case adapted to circulate through said spaces and about the converter."

24 The specification of the patent shows the details of construction of but one form of transformer. This embodies the principles that are the subject of the patent. It is illustrated in the drawings, of which figure 1 is a cross-section and figure 2 is a longitudinal section. This transformer is what is commonly termed the shell type. The special object of the invention of the patent in suit is attained by separating groups of core stampings and the coils from each other by the insertion of tubes f^1 f^1 f^2. The specification in line 68 indicates that blocks are the equivalents of tubes. The result of this insertion is the creation of open spaces between the materials of the electric and magnetic circuits. The new surfaces exposed by the creation of these open spaces serve as new places of exit for the heat which is produced in the magnetic and electric circuits as a result of the operation losses. This heat is taken up by a non-conducting fluid or gas, which fills the open spaces and surrounds the transformer. The heated portions of the fluid or gas undergo an expansion as a result of the rise in temperature, and this produces a decrease in the specific gravity of these portions. These portions are then buoyed up, and in rising to the top of the fluid set up circulating currents. The internal surfaces of the core and of the coils are in this manner bathed by the fluid or gas, and the heat is abstracted from them and conveyed by the circulating currents to the enclosing transformer case, which in turn gives it to the surrounding air and other objects. The specification does not state in what position the transformer should be when in operation. The lettering of the parts of the drawings and the numbering of the figures indicate, however, that the left-hand side of the sheet is the top. This position offers the greatest facility for the escape of the heat by the circulation process just mentioned, because the greater number of oil channels are vertical and the tendency of the heated oil is to rise. The creation of open spaces may necessitate the use of a greater length of wire or

25 a greater volume of iron. In this case the losses are somewhat increased, or, what is the equivalent, the efficiency of operation is impaired. Decreased temperature elevation may thus be purchased at the expense of efficiency of operation.

There has been prepared a wooden model of the structure depicted in the figures of the patent in suit, and which I now produce and mark "Complainant's Exhibit Westinghouse Model." The red surfaces running from end to end of the core formed by the blocking apart of the coils and the red surfaces running transversely to the groups of core plates and formed by the intervening tubes or blocks, are the internal surfaces of the core to which I have just referred and which are bathed by the non-conducting fluid. It will be noticed that the groups of core plates are represented by the blocks or strips of wood painted black on the outside, the coils by the green pieces of wood which project from either end of the assembled core, and the tubes f^1 f^1 of the patent by the hollow

wooden rods painted yellow. The open spaces which are between the groups of core plates are vertical when the device is arranged and situated as the figures of the patent drawings. This is probably purposely so arranged, as they are more numerous and of greater combined area than the transverse open spaces, so that they offer the greatest facility for the circulating currents which are most efficient in a vertical direction, and thereby the greatest amount of heat is abstracted. If the transformer were built to be placed with its respective parts turned to a position at right angles to that exemplified in figure 1 of the patent—that is, with its core plates lying horizontally instead of vertically—then the most natural thing to do would be to enlarge the open spaces formed in the coil openings which would then be vertical and diminish or even do away with the openings between the groups of plates.

Comparing now the defendant's structure shown in figure 24 on page 13 of the "American Electrician" of January, 1900,
26 with the structure of the patent in suit, I find that the core stampings are separated into groups by blocks, as is clearly evident in the cut, and as covered in the stipulation. It is furthermore stipulated that the structure is a transformer; that it was enclosed in a metal case which contained a non-conducting fluid which circulated through the open spaces in the laminated core. It remains, therefore, to be determined simply whether these open spaces between the core plates are open spaces, as those words are used in the fourth claim of the patent in suit. The characteristics of the open spaces of this claim, as I understand them, are, first, that the spaces must be in the core of the transformer; second, that they must supply heat to the surrounding fluid in order to set up circulating currents; third, that these circulating currents must abstract heat from the internal surfaces which bound these open spaces; fourth, that the spaces must be so constructed as to permit the surrounding fluid to circulate. The first characteristic is true of the open spaces of the defendant's structure, as is evident by a mere inspection of the figure 24. The fourth characteristic is present in the structure, according to the stipulation. These two characteristics being present, the two other characteristics must also be present when the transformer is operated under anything like its normal load.

Concerning the defendant's structure described and illustrated in its Catalogue No. 102, Bulletin No. 59, 1903, and which it is stipulated that the defendant did manufacture and sell, I find that it consists of a combination of the four elements mentioned in the fourth claim of the patent in suit, namely (1) an electric converter; (2) open spaces in its core; (3) an enclosing case; (4) a non-conducting fluid or gas in said case adapted to circulate through said spaces and about the converter. The converter or transformer is of the shell type, as is that depicted in the patent in suit. The shape of the core stampings and a cross-section, showing the
27 disposition of the primary and secondary coils, is to be seen on page 7 of the bulletin. The open spaces in its core are created and maintained by space blocks, and are clearly shown in

the above mentioned cut. The structure is designed to operate with its core plates in a horizontal plane. Under these circumstances the open spaces which are transverse to the plates of the structure as depicted in the figures of the patent in suit, are utilized and their location can be readily seen in the upper portion of the figure on page 7 of the catalogue.

There has also been prepared a wooden model representing this defendant's structure, which I now produce and mark "Complainant's Exhibit Wagner Model." The same scheme of colors has been used in painting this model as in the model marked "Complainant's Exhibit Westinghouse Model," namely, the coils are painted green, the outside surfaces of the core plates black, the space strips yellow, and the internal core surfaces of the open spaces red. The structure which this model represents is mounted in an enclosing case, which is shown on page 2 of the Bulletin. The open spaces form vertical channels which are particularly well adapted to facilitate the circulating currents in a non-conducting fluid oil with which the case is filled. That the defendants in this structure have used this combination of these four elements for the attainment of the specific results which constitute the object of the invention of the patent in suit, is proclaimed by them in their Bulletin, which says (page 4):

"The cross-section of a 15 K. W. transformer, on page 7, illustrates very clearly the excellent provision that has been made for cooling primary and secondary coils, and iron, by keeping up a natural circulation of oil. This is one of the most important advantages of the shell type transformer. These oil ducts are so proportioned and so placed that, while they keep all parts of the transformer cool and thus prevent deterioration of insulation and reduce ageing of iron to a minimum, they cause a minimum loss in efficiency."

28 It is entirely immaterial in my judgment that the defendant has made the longitudinal open spaces the effective ones for effecting the oil circulation, for it has simply enlarged the same longitudinal passages shown in the patent in suit, namely, those formed by the spacing apart of the coils, and the defendant has so located its open spaces for the obvious reason that the arrangement of parts it chooses makes these the vertical openings, while the patent in making the core plates vertical must block them apart to get vertical openings in the core. This is clearly shown in the models.

I therefore find that the two structures of the defendant, namely, the one shown in the "American Electrician," and the one described in the defendant's Catalogue No. 102, embody the combination of the four elements which constitutes the fourth claim of the patent in suit, and this combination is used for obtaining the specific results which are aimed at by the structure of the patent.

SAMUEL SHELDON.

Direct examination closed.

Complainant's counsel offers in evidence the model first referred

to by the witness, and the same is marked in evidence "Complainant's Exhibit Westinghouse Model, B. B., Ex'r."

Complainant's counsel offers in evidence the second model referred to by the witness, and the same is marked in evidence "Complainant's Exhibit Wagner Model, B. B., Ex'r."

Complainant's counsel states that relief is asked as to claim 4 only of the patent in suit.

Complainant's counsel states that, at the request of defendant's counsel, Mr. A. C. Fowler, the cross-examination of the witness is deferred to such time as it shall suit the convenience of defendant's counsel to attend in New York, provided, however, that such
29 cross-examination shall be arranged to take place on or prior to June 22d, 1903.

Adjourned to meet upon agreement.

No cross-examination.

Prima faci proofs closed.

United States Circuit Court, Eastern District of Missouri, Eastern Division.

No. 4457. In Equity.

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, Complainant,
vs.
WAGNER ELECTRIC MANUFACTURING COMPANY, Defendant.

Defendant's Testimony.

Testimony taken in the above-entitled cause under the 67th Rule in Equity, as amended before James R. Gray, Esq., Standing Examiner of the above Court, at the offices of Fowler & Bryson, Commonwealth Trust Building, St. Louis, Missouri, on behalf of the defendant, beginning at 3 o'clock in the afternoon of Wednesday, August 5th, 1903, in pursuance of the annexed notice.

30 ST. LOUIS, WEDNESDAY, 3 P. M.
August 5th, 1903.

Present: Byron F. Babbit, Esq., on behalf of complainant; A. C. Fowler, Esq., on behalf of defendant.

Defendant's counsel states that he is willing and anxious to give Second Circuit, and similar to the terms of the preliminary injunction to which he heretofore consented and which was heretofore issued herein, enjoining the defendant from making, using and selling apparatus substantially similar to that involved in the Union Carbide cases, and that he has always been ready to let the preliminary injunction granted herein stand until the expiration of the patent herein, or to make said injunction permanent, and he the complainant a permanent injunction herein covering claim 4 of the patent in suit, as interpreted by the Court of Appeals of the

now makes this offer to the complainant to avoid the costs and expenses of this suit; but states that he is not willing and does not consent to any injunction covering the defendant's structure described in Defendant's Catalogue No. 102, Bulletin No. 59, 1903, and embracing the forced or strained construction which the plaintiff is now endeavoring to place upon claim 4 of the patent in suit and defendant's counsel states that if complainant prosecutes this suit to establish this latter construction of claim 4 of the patent in suit, and is unsuccessful with reference thereto, but prevails as to the same issue which is involved in the Union Carbide cases only, that defendant's counsel shall insist upon complainant paying the costs incurred herein.

Defendant's counsel offers and puts in evidence a printed copy of the record in the case of the Westinghouse Electric and Manufacturing Company against the Union Carbide Company which was pending in the United States Circuit Court of Appeals
31 for the Second Circuit, and involving the patent here in suit, and the same is marked "Defendant's Exhibit No. 1, Printed Record, Union Carbide Case."

It is stipulated and agreed by and between counsel that this record may be used in evidence with the same force and effect as if duly certified.

Defendant's counsel offers and puts in evidence a certified copy of the moving affidavits filed with the bill of complainant herein, on which preliminary injunction herein was consented to and issued by this Court; and the same is marked "Defendant's Exhibit No. 2, Plaintiff's Moving Affidavit on Preliminary Injunction."

Defendant's counsel offers and puts in evidence Catalogue No. 102, Wagner Electric Manufacturing Company, Bulletin No. 43, dated 1901, and corresponding to the Wagner Catalogue No. 102, offered in evidence by complainant's counsel, which latter was dated 1903, and the same is marked "Defendant's Exhibit No. 3."

Defendant's counsel offers and puts in evidence copy of the opinion by Judge Amidon in this case on motion to punish defendant for contempt of Preliminary Injunction, theretofore issued in this cause and for further preliminary injunction herein, and same is marked "Defendant's Exhibit No. 4, Copy Judge Amidon's Decision."

It is stipulated by and between counsel that said copy of the said opinion may be used in evidence with the same force and effect as if duly certified.

Defendant's counsel offers and puts in evidence printed Patent Office copy of United States Patent, No. 210,987 to D. Brooks, patented December 17th, 1878, for insulating induction
32 coils, and the same is marked "Defendant's Exhibit, No. 5, Brooks Patent."

Defendant's counsel offers and puts in evidence printed Patent Office copy, United States Patent No. 266,290, granted to Hindley & Buffham, patented October 24th, 1882, for Dynamo Electric Generator and the same is marked "Defendant's Exhibit No. 6, Hindley & Buffham Patent Co., No. 266,290."

Defendant's counsel offers and puts in evidence printed Patent Office copy of United States Patent, No. 269,036, granted to A. D. Fisher, patended December 12th, 1882, for Armature for Dynamo Electric Machines, and the same is marked "Defendant's Exhibit No. 7, Fisher Patent."

Defendant's counsel offers and puts in evidence printed Patent Office copy, United States Patent No. 270,457, granted to A. Millar, patented January 9th, 1883, for Magnetic Electric Machine, and the same is marked "Defendant's Exhibit No. 8, Millar Patent."

Defendant's counsel offers and puts in evidence printed Patent Office copy, United States Patent No. 271,169, granted to A. G. Waterhouse, patented January 23d, 1883, for Electric Induction Machine, and the same is marked "Defendant's Exhibit No. 9, Waterhouse Patent."

Defendant's counsel offers and puts in evidence printed Patent Office copy of United States Patent No. 342,553, granted to G. Westinghouse, Jr., patented May 25th, 1886, for an induction coil and the same is marked "Defendant's Exhibit No. 10, Westinghouse Patent."

Defendant's counsel offers and puts in evidence printed Patent Office copy, United States Patent No. 349,617, granted to W. Stanley, Jr., patented September 21st, 1886, for an induction
33 coil and the same is marked "Defendant's Exhibit No. 12, Stanley Patent No. 349,617."

Defendant's counsel offers and puts in evidence printed Patent Office copy, United States Patent No. 349,616, granted to W. Stanley, Jr., patented September 21st, 1886, for an induction coil and the same is marked "Defendant's Exhibit No. 12, Stanley Patent No. 349,616."

Defendant's counsel offers and puts in evidence printed Patent Office copy, United States Patent No. 352,105, granted to Zipernowsky, Deri & Blathy, patented November 2d, 1886, for an induction coil, and the same is marked "Defendant's Exhibit No. 13, Zipernowsky *et a* Patent."

Defendant's counsel offers and puts in evidence printed Patent Office copy of United States Patent No. 360,122, granted to E. Thomson, patented March 29th, 1887, for a system of electric distribution, and the same is marked "Defendant's Exhibit No. 14, Thomson Patent."

Defendant's counsel offers and puts in evidence printed Patent Office copy, United States Patent No. 349,612, granted to W. Stanley, Jr., patented September 21st, 1886, for an induction coil, and the same is marked "Defendant's Exhibit No. 15, Stanley Patent No. 349,612."

Defendant's counsel offers and puts in evidence printed Patent Office copy of United States Patent No. 428,574, granted to W. Stanley, Jr., patented May 20th, 1890, for an electrical converter, and the same is marked "Defendant's Exhibit No. 16, Stanley Patent No. 428,574."

Defendant's counsel offers and puts in evidence printed Patent Office copy of United States Patent No. 265,936, granted to E.

Thomson, patented October 10th, 1882, for means for preventing flashing between electric conductors, and the same is marked "Defendant's Exhibit No. 17, Thomson Patent 265,936."

34 Defendant's counsel offers and puts in evidence printed Patent Office copy, United States Patent No. 366,347, granted to A. Schmid, patented July 12th, 1887, for an electrical converter, and the same is marked "Defendant's Exhibit No. 18, Schmid Patent."

Defendant's counsel offers and puts in evidence printed Patent Office copy of British Letters Patent No. 9728 of 1887, granted as a communication from abroad to George Westinghouse, Jr., of Pittsburgh, Pennsylvania, for improvements in electrical converters and boxes for the same, and the same is marked "Defendant's Exhibit No. 19, Westinghouse British Patent."

At this stage of the proceedings, by consent of counsel, an adjournment was taken to Thursday morning, August 6th, 1903, at 10:30 o'clock.

Met pursuant to adjournment on Thursday morning, August 6th, 1903, at 10:30 o'clock. Present, as before. The further taking of testimony continued.

Deposition of Francis E. Nipher.

FRANCIS E. NIPHER, a witness produced on behalf of defendant, being first duly sworn, testifies as follows:

Direct examination by Mr. FOWLER:

Q. 1. Please state your name, age, residence and occupation?

A. Francis E. Nipher; age, 55; residence, St. Louis. I am professor of Physics in the Washington University.

35 Q. 2. What experience have you had to qualify you to testify as an expert in patent causes and particularly with reference to electrical apparatus.

A. Since 1874 I have been Professor of Physics at Washington University, St. Louis. It has been my business to give instruction in electricity and magnetism. In 1885 I began to give instruction to the engineering classes on electrical machinery. This instruction involved the theory of such machinery as was then in use, the methods of testing and operating such machinery, as well as the general principles of design of such machinery for specific work. As the art grew, the scope of the instruction widened until in 1891, a formal course in electrical engineering was established. This course was placed in my charge and has so remained until a couple of years ago. For several years part of the instruction in electrical engineering has been given by my former student who was later my assistant, Mr. A. S. Langsdorf. A large amount of money has been recently given for the Department of Electrical Engineering, and to meet the wishes of the donor, who provided a separate building for Electrical Engineering, a Professorship of that branch has been created and Mr. Langsdorf was, at my recommendation, appointed to

that place. My work in physics is now carried on in a separate building. All of the engineering students are under my instructions.

In 1881 I was the technical adviser of the Heisler Electric Light Company, of St. Louis, and was director in the company. The company introduced the use of alternating current in this country and before 1887 the company manufactured and sold alternating-current machines. These machines were used both for internal and for street lighting and both arc and incandescent lamps were used. Some of the circuits in such plants were ten or twelve miles long. These lighting plants were installed in all parts of the country from the Atlantic to the Pacific and in Canada. The difficulties which then taxed us severely to overcome, caused me to take a deep
36 interest in the transformer when it afterwards became a commercial factor. I gave great attention to it in my instructions against the remonstrances of many engineers who thought that there was no future in the commercial world for the alternate-current machine. Transformers designed by me for special purposes were built in my own shop at Washington University, and under my supervision, and they, with others purchased from dealers have been used for years in my laboratory.

I am a past-president of the Engineers' Club, of St. Louis, and also of the Academy of Science, of St. Louis. In the publications of these bodies I have published various papers of a more or less original character, bearing upon the design or the theory of electrical and steam machinery. I am also the author of a mathematical treatise on electricity and magnetism, designed for advanced under-graduate students in electrical engineering which has had a wide use among the larger schools of the country. I have frequently been called upon to test electrical machinery where litigation was threatened. Sometimes both parties to the controversy have asked me to decide between them and have agreed to abide by my decision, and in some cases where only one party to the dispute engaged my services, both parties have accepted my report, and have settled their disputes without litigation.

I have been called in several important cases where patent litigation has involved electrical machinery, to assist in arriving at the meaning and scope of patent claims in view of the prior art. In connection with this work I have visited many large plants in the East and have assisted in making tests of such plants already installed or in the shops of the manufacturers.

Q. 3. Have you read and do you understand the letters patent here in suit, the same being Letters Patent No. 366,362, granted July 12th, 1887, to George West-nghouse, Jr., and having more particular reference to the subject matter claimed in claim 4 of said patent?

37 A. I have read all of the patent referred to and have carefully considered all of the claims including claim 4 and believe that I understand the patent.

Q. 4. Have you read and do you understand the record in the suit brought on this patent against the Union Carbide Company, including copy of the decision of the Court of Appeals for the Southern District of New York, in that case?

A. I have read the record referred to and believe that I understand it. I have also read the opinion of the Court of Appeals in that case and believe that I understand it.

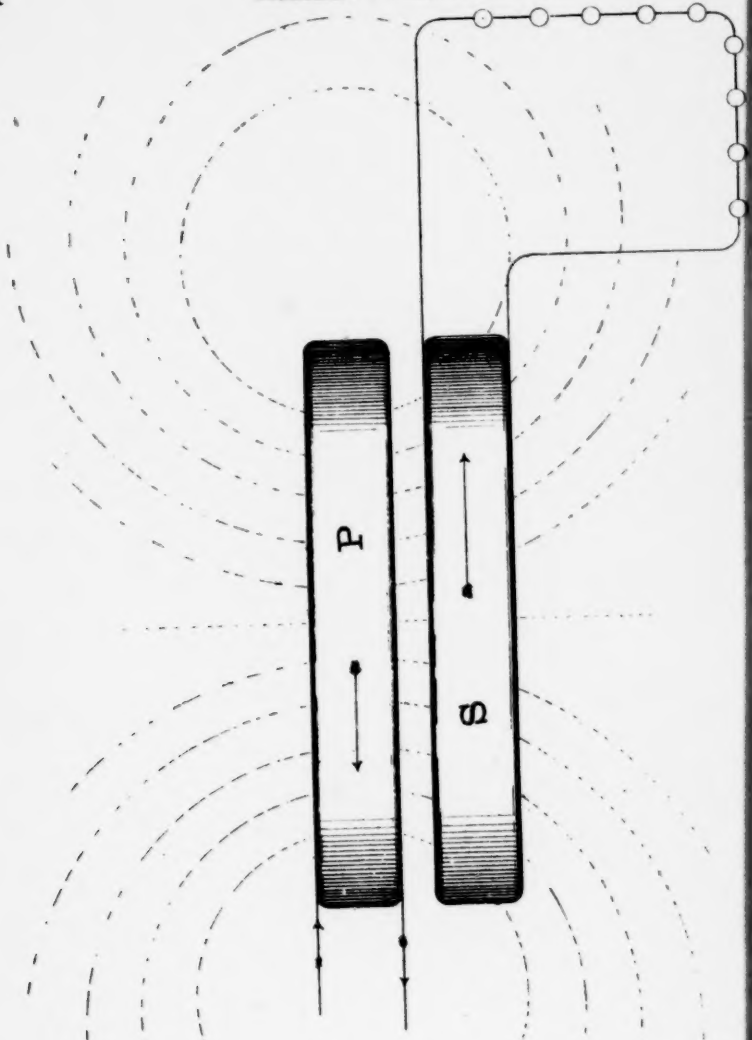
Q. 5. Will you please set forth the state of the art prior to the date of the application for the patent here in suit, to-wit, prior to December 27th, 1886?

A. The static transformer and the transformer where part of the mechanism is in motion took their origin at about the same time, in the work of Faraday, and their development -as been simultaneous.

In the static transformer all parts of the mechanism are at rest. The action of such a transformer may be easily explained by means of a little sketch, which I here present (Defendant's Exhibit, No. 20).

(Here follows diagram marked p. 36*a*.)

Defendant's Exhibit No. 20.



No. 179.
Westinghouse Co.
v
Wagner Co.
p 36a

This sketch shows two flat coils of wire like the three coils concentrically placed, shown in figure 337 of Wagner Catalogue, No. 102, Bulletin No. 59 of 1903, forming one of complainant's exhibits in this case. In this sketch the coils are shown edgewise of the same size and in parallel position. If a continuous current be sent through coil P, a magnetic field is produced around it. The presence of this field is indicated by a magnetic needle which will set in a definite direction with respect to the coil P. The direction of the needle is tangent at every point to dotted lines which I have drawn in the sketch. The space around this coil has acquired new properties due to the presence of the current passing continuously through the coil. Such a space is called a magnetic field. These dotted lines of direction are called lines of force or lines of induction, and correspond to the lines of force in the earth's
38 gravitation field, indicated by the plumb-bob. While this current is rising from zero to its final value these lines appear proceeding from the wire carrying the current and with constantly enlarging diameters they travel outward into space. While they are doing so they cut across and link with the windings of the secondary-coil S. At each point in the field the magnetic force is increasing. While this is going on an electric current is set up in the secondary-coil S. (The ends of this coil being connected). When the current in the primary-coil P, has reached its limiting value the magnetic field is the constant in strength and the lines of force represented by the dotted lines are stationary and in position. The current in the secondary coil is opposite in direction from that of the inducing current in E. This secondary coil S, traversed by a current thus induced also has a magnetic field opposite in direction from that of the primary. The fact that it is opposite is indicated by the magnetic needle whose north end would point in the opposite direction. The secondary coil, in other words, acts against the primary coil and tends to resist the change which is being brought about through the agency of the imposed current in the primary. When the primary current has reached its final value and the magnetic field due to it has been established the secondary current in S has gradually diminished to zero. It ceases its opposition to the primary so soon as there is no longer any change. If the primary circuit is now opened by breaking the wire the current will quickly fall to zero. It, however, takes times to do this. During this time the magnetic lines shown by the dotted lines in the sketch diminish in diameter and disappear in the wire from which they came. The magnetic field becomes weaker and disappears. While this is going on a current develops in the secondary coil S, opposite in direction to what it had before and the same in direction as that diminishing current in the primary coil P. The secondary coil now produces a magnetic field in the same direction as that of the primary.
39 It is aiding the primary. Its action is again to resist the change which is going on. It is striving to maintain the disappearing magnetic field. But this induced current in S ceases when the primary current has ceased to change or has become zero. The same phenomena would appear if the connections of the primary

coil were now reversed and a current were sent through it in the opposite direction. But the induced currents in S would then be opposite in direction to those which they had before. Any change of the current in P produces opposing current in S. If an alternating — be sent through the primary P an alternating current will be induced in the secondary coil S. This arrangement is a static transformer. If a continuous or uniform current be sent through P and allowed to reach its constant value we may produce currents in the secondary wire S by moving either or both coils further apart or nearer together. If S is moved away from P it is being carried out into a weaker part of the field. The same current is then developed in S that was developed when the primary circuit was opened. The currents in the two coils would then be parallel in direction. In this case it is found also that they attract each other. In other words, the imposed motion is resisted. If it is brought back the induced current is the opposite in direction from the primary, and the coils then repel each other. This arrangement is also a transformer. Induced currents are produced like those in the static transformer. In each case every imposed change is resisted. All of these things are known from experiment, just as we know from experience that every movement in society or in politics provokes counter movements.

If a permanent current is sent through P and coil S be moved from a stronger to a weaker part of its field the device is then said to be in ordinary language a generator or dynamo. The coil containing the permanent current is called the field. The armature must be moved by some source of power like a steam engine.

And the coils shown in this sketch are so placed in combination with other coils, producing duplicating and co-operating action, that either the secondary or the primary coils can be given a rotary motion.

This motion can be produced by a steam engine or any other source of power.

In answering this question concerning the state of the art both the static and the rotary transformer will be refer-ed to.

At this stage of the proceeding a recess was taken until 2:30 this afternoon.

At 2:30 further proceedings were had as follows:

Present: As before.

FRANCIS E. NIPHER further testified as follows:

I refer now to U. S. Patent No. 210,987 of 1878 to David Brooks. This patent is for an improvement in insulating induction coils. The drawing shows a static transformer immersed in a tank of oil. The coils are concentric and cylindrical in form. The two wires are apparently wound on the same spool, and are led out together over the edges of the tank. This is the method now used in all of the large plants where oil is used to insulate and cool transformers. There is in this device a superabundance of oil—much more oil than is needed for mere insulation, but which would be effective in keeping the coil cool. At the time when this patent

was granted, however, such transformers were only constructed in what would now be called small units, and they were not used in continuous operation over long periods of time for commercial lighting, so that the question of cooling the transformer was, at that time, of no commercial importance. The speci-

41 fication reads:

"In the drawing, A is an ordinary induction coil or coils, or bobbins of wire, with their positive and negative poles a a^1, and B is a vessel of any suitable shape or size, containing an insulating liquid, preferably paraffine-oil. I immerse the bobbins or coils, as shown in the drawing, and the coils, being thus immersed in the liquid, are protected from the influence of the damp atmosphere."

The single claim of the patent is for this method of insulating induction coils or bobbins of wire by immersing them in a liquid insulating substance. A fine wire and a coarse wire are shown leading out from each end of the apparatus. The only difference between this arrangement and those in modern use is a difference of design determined by the specific use to which the transformer is applied. Modern transformers differ as much from each other as this transformer does from modern transformers. I have in my laboratory today a transformer of this sort as manufactured by the General Electric Company at the present time. It is designed for higher insulation and the large wire is therefore kept away from the fine wire coil. They are, however, concentric and the whole is mounted on swinging supports in a wooden box of oil having a removable cover through which the discharge rods leading to the high potential wires are passed through loosely fitting holes. This transformer of the Brooks Patent would not be suitable for outdoor work in a rain storm if made exactly as is here represented It would work just as it is here shown in an ordinary room, although it would be desirable to place a cover on the box in order to keep out the dust. This cover would also incidentally adapt the instrument to working in an atmosphere containing more moisture than it would be feasible to use this precise arrangement in as it is shown in the drawing of the patent. That, however, is all a matter of degree and design. The oil filled transformer of the present day is shown in this drawing and is clearly de-

42 scribed to any one skilled in the art. There is nothing said in this specification about the function of the oil in cooling the transformer but the specific device shown is adapted to that purpose and it did as a matter of fact perform that function in this apparatus.

I next refer to U. S. Patent No. 266,290 to Hindley & Buffham, patented October 24th, 1882. This patent is for a rotary transformer or dynamo electric generator. The stationary coils constituting the field magnet are marked a in figure 1. They are provided with iron cores m passing through them. These cores increase the strength of the magnetic field, due to the stationary coil and had this field to a cylindrical space in which the movable coils are rotated by means of a steam engine. The stationary coils in the core constitute the field magnet and the rotary coils con-

stitutes the armature. If the armature were not driven but allowed to stand still in the position shown in figure 1 this device might also be used as a static transformer. To explain this let us look at figure 1 from the position which shows all of the letters erect. Pass an alternating current through the coils of the field marked *m*. The lines of magnetic force or induction would pass through the coil just to the right of the shaft *a* flowing through this coil to and fro in opposite directions. The strength of field rises to a maximum diminishes to zero, reverses and then rises to a maximum in the opposite direction sinking to zero again. This produces an alternating current in this vertically placed coil which has its plane at right angles to the magnetic field. Precisely the same effect is produced if a continuous current be passed into the stationary coils *m* and the coil be rotated through one revolution around the axis *a*. Starting from the position shown if the coil be rotated 90 degrees its plane is edgwise in the field. The condition now is exactly the same as it was in the former case when the alternating current was zero for no lines now thread through this coil. It is the same as if it had been suddenly removed to an infinite
43 distance. Revolving the coil another 90 degrees brings it into the same position again as shown in the figure but the sides of the coil are now in reversed position. It is as though the coil which had been removed to an indefinite distance from the permanent field had been turned through 180 degrees and then brought back again to its initial position. In figure 1 the coils are placed at various angles on the armature so that when one of them is in a position of greatest effectiveness the others will be in intermediate positions ranging from maximum to zero effects. When these coils are properly connected they, therefore, add their effects and produce a resultant current nearly continuous if a direct current is desired. In this transformer or generator there are open spaces in the core of both the primary and the secondary coils. The arrangement of these open spaces is one of the objects of the invention. This object is stated at the beginning of the specification, page 1, line 13, consists—

"In a novel manner of arranging the wire whereby openings or spaces are provided for the free circulation of the air."

The wire here referred to is the iron wire constituting the core of the field magnet and constituting the core of the armature. These open spaces in the core of the field magnet *m* are shown in the sectional drawing at the left end of the machine in figure 1 and they are also shown in the cross-section through *y y* of figure 1, in figure 4. Figures 2 and 3 show the open spaces in the iron core of the armature. In figure 2 they are shown between the pole pieces *g* which project up between the copper coils *c*. This iron wire core is wound on a spool or frame in annular sections as is seen in figure 3, and these annular sections are separated from each other by spacing blocks. This apparatus cannot be operated to advantage when submerged in oil because of the frictional resistance to the rotation of the armature and for other obvious

reasons. On the other hand it has the advantage of pro-
44 ducing an air circulation due to the motion of the armature and this makes a ventilation much more effective than is the case in a static transformer. What this device, therefore, shows is a construction designed

"To overcome in a great degree the generation of heat in a dynamo electric machines, * * * by leaving or forming air passages or openings in the iron-wire body and the enveloping copper coils of both" (referring to both armature and field, page 1, lines 33 to 41).

In referring to these open spaces *f*, figure 3, in the iron core and to the open spaces *j*, figure 1, of the copper windings, the inventor says in summation after fully describing them, page 1, line 83:

"It will thus be seen that the spaces *f* and *j* cross each other at right angles and that numerous and uninterrupted passages are thereby afforded for the travel of air from the outside to the inside of the armature cylinder or *vice versa*, both the (iron) core-wire bundles and the (copper) induction-wire bundles being exposed to the air on all sides."

The inventor states in line 94 of page 1 that the field magnet is constructed in the same way as is easily seen in figure 1. The main object of this invention is to separate the copper coils and the iron core of both armature and field into sections having open spaces between in order to thereby increase the radiating surface per pound of material used and for the sole purpose of keeping down the temperature of the machine. Claim 4 of the patent covers this construction of the iron core of both armature and field. It reads:

"4. In a dynamo-electric machine the combination of a field magnet and an armature, both formed with cores of wire arranged in groups or bundles, said bundles being separated by open spaces."

45 I next refer to U. S. Patent 269,036 to A. B. Fisher, dated December 12th, 1882. This patent is for "An Improvement in the Armature for Dynamo-Electric Machines." This armature consists of rings of soft iron ribbon, such as are shown in figures 2 and 3, wound side by side upon a cylindrical frame as shown in figure 1. This frame consists of two end wheels mounted on a shaft and metallic bars parallel to the shaft and fastened to corresponding ends of the spokes. These rings of soft iron ribbon D are "Placed a sufficient distance apart to allow air spaces H which provide suitable ventilation to the armature and prevent heating of the metal." The copper wire is also wound longitudinally on this cylinder in sections which are determined by the radial pins shown in figures 2 and 3, and which also extend in a line along the whole length of the cylinder as is shown in figure 1. Between these pins along the cross-section of figure 1 there will be air spaces between the sections of the copper wire. These air spaces cross the openings or air spaces in the iron core at right angles, so that the armature is fully ventilated by the radial ventilating channels so formed.

I next refer to U. S. Patent 270,457, dated January 9th, 1883, to

A. Millar for magneto-electric machines. This machine may have, as a field magnet, permanent magnets *c* shown in figures 1 and 3, or may have an equivalent electro-magnet, in which case the machine would be a dynamo-electric machine or generator. This machine has also armatures having the same form as the field magnets. They are marked *e* in figure 3. Both the field magnets *c* and the armatures *e* are "U" shaped magnets. Each field magnet bestrides an armature magnet, and they are placed radially, each group of two being attached to an arm of a star-shaped support shown in figure 4. The upper ends of these magnets terminate in pole pieces, those of the field magnet being marked D, and those of the armature being marked F, both armature and field magnets are stationary in the operation of the machine.

46 At this stage of the examination an adjournment was taken until Friday morning, August 7th, at 10:30 o'clock.

Met pursuant to adjournment this 7th day of August, 1903, at the hour of 10:30 o'clock A. M.

Present, Same counsel for defendant; Mr. Babbitt and D. W. Cooper for complainant.

By agreement of counsel, the following objections are made by complainant's counsel with the same force and effect, as though entered simultaneously with the items of evidence to which they refer:

Complainant's counsel objects to the offers in evidence of the various United States Letters Patent prior to the patent in suit, and to all testimony respecting them as inadmissible under the pleadings in the case, for the reason that the answer admits that the patent in suit has been adjudicated between these parties to be valid as to its fourth claim, and the answer does not allege any defense to the said fourth claim, infringement of that claim also being admitted.

Complainant's counsel further objects to such evidence, for the reason that the answer admits that the defendant has infringed the said fourth claim, and, therefore, the only admissible evidence on the part of the defendant is with respect to infringement by the manufacture and sale of the devices proven in the prima facie case.

Complainant's counsel objects to the offer of and marking in evidence of Exhibit No. 2, Plaintiff's Moving Affidavit for Preliminary Injunction; Defendant's Exhibit No. 4, Judge Amidon's

47 Decision, as incompetent on the final hearing.

Complainant's counsel objects to the offer and marking in evidence of the alleged catalogue marked "Defendant's Exhibit No. 3," because the same has not been proved.

Complainant's counsel states that he has come from New York to attend the taking of this testimony on the statement by Mr. Fowler that he, Mr. Fowler, wished to finish, so as to leave for his vacation on Monday, and on the statement by complainant's counsel that complainant's counsel would finish this examination by Saturday night. Complainant's counsel states that he is under orders of Court to finish the testimony in a cause pending in the U. S. Circuit Court for the District of New Jersey on Monday, the 10th inst.; that prior

to leaving New York, and in view of this case, he arranged with the opposing counsel, with the Master and with three witnesses in the New Jersey case, to take that testimony on Tuesday and Wednesday, the 11th and 12th instant, the time there having been specially enlarged, because of the circumstances of this case, for that purpose; that he is willing to attend here at all hours of the day and evening to-day and to-morrow in order to finish this testimony by to-morrow night, and that he will agree that the testimony of more than one witness may be taken at the same time in order to expedite matters.

Defendant's counsel, Mr. A. C. Fowler, states, in response to the statement of complainant's counsel, that he stated to Mr. Byron F. Babbitt, local counsel for the complainant, that he wished to start on his vacation the first of next week, on Monday night, if possible; that he has never stated to any one that he would finish by Saturday night. That his time in this case has been limited on com-

48 plainant's own motion when he was absent from the city and could not attend. That it is his wish to complete the taking of these depositions and of the testimony in defendant's case at this session, and then to go on his vacation. That in the month of September he has peremptory engagements which will prevent his taking up this case. That Mr. W. A. Layman, another witness he wishes to examine, is out of the city at present. That he has just stated to complainant's counsel that he did not wish to proceed with the taking of testimony in this case on Saturday afternoon, as it is the custom here, as in New York, to have Saturday afternoon holiday in summer time.

Complainant's counsel states that he will object, under the circumstances heretofore noted, to an adjournment on Saturday noon, unless the depositions be finished at that time, but that if, after all reasonable efforts to close this testimony by the night of the 8th inst. have failed, he will consent to an adjournment from that date to the morning of the 14th inst., and will agree to return to St. Louis on the last-named day in order to finish the testimony by the 15th inst.

Defendant's counsel states that he is unwilling to consent to this, as it will preclude him from getting his vacation, concerning which he notified Mr. Byron F. Babbitt at the time of serving notice of the taking of this testimony. Defendant's counsel further states that the taking of testimony in this case has already proceeded for a day and a half without the presence of Mr. Cooper, and since this session commenced, at which Mr. Cooper has been present, not a line of testimony has been taken, yet Mr. Cooper insists that he must leave here Saturday evening and that two days is all that he can devote to the taking of this testimony.

49 The witness, continuing, says:

The primary and secondary elements in this Miller device are magnetically connected with each other by soft iron rollers of a conical form shown in figures 3 and 5. In figure 3 these rollers revolve on a shaft, being carried on the arms of a star-shaped support attached to a rotating shaft above the tank or vessel containing

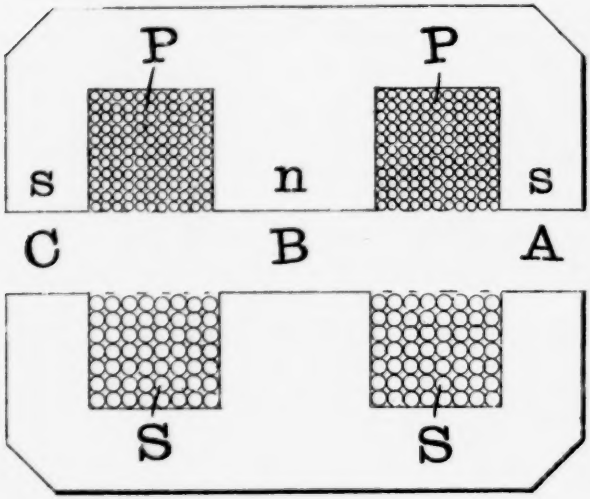
the primary and secondary cores and windings, as is shown in figure 3. One roller unites the two external pole pieces D and F of figure 4, the other roller unites the internal pole pieces D F, which are nearest to the axis of rotation. The primary magnet C being permanently magnetized when the arm of these U-shaped magnets are by the rollers connected to corresponding arms of the secondary magnet, the magnetic field pours into the core of the secondary, producing an induced current therein in coils *e*. When the roller passes on, the magnetic circuit is interrupted and the current again produced in the secondary coil *e*. The action in this case may be illustrated by a sketch which I here produce, showing in cross-section

(Here follows diagram marked p. 48*a*.)

a modern transformer, the core of which is split longitudinally in the plane separating the primary and secondary coil. If a continuous current be sent through the primary coil P, magnetic polarity will be developed in the iron core, as is shown by the letters N and S. If the gap between the ends of the iron at A B and C be bridged across by iron rollers, which are alternately applied and removed, the iron core of the secondary coil S will be alternately magnetized and demagnetized, and alternating currents will be developed in the secondary coil. This is precisely the way the Millar device operates. The Millar device is a static transformer so far as its primary and secondary coils are concerned, and these coils, with their iron cores, are mounted in a tank of heat-absorbing liquid, paraffine oil being mentioned. The object of this liquid is to keep down the temperature by absorbing the heat (Specifications, page 2, line 54). This oil tank is shown in figure 3, with a closely fitting cover. The joints around this cover appear to be of the same kind as the joints around the base of the tank. There are, however, no open spaces in the core of either the primary or the secondary coils. This device does, however, show a combination of an electric converter, an enclosing case and a non-conducting fluid or gas in said case adapted to circulate about the converter.

I now refer to U. S. Patent 271,169 to Waterhouse, dated January 23d, 1883. This device resembles in many respects the Millar device just described. The primary and secondary windings are placed on an iron core formed like the ring of a Gramme dynamo. This ring is stationary. The primary windings are excited by a continuous current passed in at one end of the shaft into a commutator carried by this shaft. The secondary windings are similarly connected to a rotating commutator at the other end of the shaft. In this way pulsating currents are produced in these stationary coils. The coils in this transformer are separated from each other by open spaces. The coils pass around and link with the iron core in this case just as

Defendant's Exhibit No. 21.



No. 179.
Westinghouse v. Wagner Co.
p. 48a

in the patent in suit, the iron core surrounds and links with the copper coil. I do not, however, think that it would be fair or proper to say that these copper coils and the spaces between them are in the iron core. It would be just as fair and just as correct to say that the coils are in the iron core as to say that the spaces between them are in the iron core. The iron core and the coils link with each other, just as the links of a chain link with each other.

I now refer to Letters Patent to Westinghouse, No. 342,553, of May 25th, 1886. This patent shows a modern transformer with air spaces left between the plates of the iron core. These air spaces are shown in figure 1 around the washers surrounding the bolt F^1 and F^2. They are also shown in figure 2 where they are marked *c*. If this transformer were put into a tank of oil this device would respond to claim 4 of the patent in suit.

I now refer to U. S. Letters Patent No. 349,617, dated September 21st, 1886, to William Stanley, Jr. This patent shows a
51 transformer in which the primary and secondary windings form a coil of octagonal shape. This coil has linked with it an iron core made up of thin plates grouped in sections or bunches. These groups or bunches of the core might be placed nearer to each other if the copper windings had a circular form and they might still be nearer to each other if the copper coils had a rectangular form like a link and these iron cores were placed on the straight side of this link. I think it would be much fairer to say that these spaces between the sections of the iron core are spaces in the core than it would be to say that they are spaces in the octagonal coil of copper. If these spaces are in the iron core this device would respond to the 4th claim of the patent in suit if the transformer were put into a tank or case of oil.

I now refer to U. S. Patent 349,616, dated September 21st, 1886, to W. Stanley, Jr. This patent shows and describes a transformer of modern type in which the plates forming the iron core are separated by washers marked *c* in figure 1, and referred to in the specification, page 1, line 64, as follows:

"These plates are separated by washers *c*, which intervene between the respective plates and prevent them from coming in contact with each other."

These spaces between the plates formed by these washers are precisely like the spaces formed in the core of the patent in suit. If this transformer were placed in a tank or case of oil, it would respond to claim 4 of the patent in suit.

I now refer to U. S. Letters Patent 352,105, dated November 2d, 1886, to Zipernowsky et al. Figures 6 and 7 show a transformer in which the primary and secondary windings are in the form of a coil seated in a base plate. The iron core is made up of plates surrounding the various legs of the coil. I refer to this device merely to point out that the space around the various sections of this
52 iron core is not in the core. In figure 7 the space between these columnar sections of the core is not in the core.

I now refer to U. S. Patent No. 360,122, dated March 29th, 1887, to E. Thomson. This patent is for a system of electric distribution

in which transformers are used. Such a transformer is represented in figure 3 and figure 4. In this transformer what is in this case used as a primary coil is divided into two sections marked 3 and 5. The secondary coil is marked D. The iron core is represented as a straight cylinder K. Respecting the device here shown the specification states (page 3, line 20):

"It is desirable to suspend both sets of coils in free air, so that they shall be separated from each other and from the core K by a clear air space all around."

This air space is shown in figure 4, where it appears to be marked X.

This aid space, which separates the coils from the core, is not in either the coils or the core. The air space between the primary coil 5 and the secondary coil D is not in any proper sense in those coils or either of them, because they are not sections of the same coil. They are used for entirely different purposes.

Recess until 2 P. M.

At 2 P. M. further proceedings were had as follows:
Present.—Same as last noted.

FRANCIS E. NIPHER, Continuing:

I now refer to United States Letters Patent 349,612, dated September 21st, 1886, to William Stanley, Jr.

In this transformer the iron core consists of an iron ring
53 made up of sheets, each one of which is provided with radial projections or teeth so shaped that coils of ordinary rectangular form can be wound in the rectangular grooves between the teeth. The specification recites (page 1, line 40) that these iron plates may be separated by an air space, a construction which was well known to the art at that time. If so made this transformer would be provided with open spaces in its core. When so built if this transformer were immersed in a tank or case of oil it would respond to claim 4 of the patent in suit.

I next refer to United States Letters Patent 428,574, dated May 20th, 1890, the William Stanley, Jr. This is a patent for an electrical converter the iron core of which is built up by iron plates cut in shape resembling the letter E as shown in figure 3. In assembling these plates to form the core each alternate plate is inserted from the opposite side, which results in symmetrical arrangement of the iron. It also results in the formation of open spaces in the coil. In figure 2, which represents an elevation of the transformer, the wires of the copper coil are shown as being visible through these open spaces. Figure 1 also shows that the primary and secondary coils are separated from each other by an intervening insulating space which is referred to on page 1, line 75 of the specifications.

I now refer to U. S. Letters Patent No. 265,936 dated October 10th, 1882, to Elihu Thomson.

The device of this patent is intended to prevent sparking on a commutator of a dynamo when either of the brushes passes from one section to another of the commutator. The effect of such sparking

is to reduce the effective insulation between the sections and to overheat the metals at the points where the commutator sections adjoin. In figure 5 of the patent the object is attained by immersing the commutator in oil contained in a casing or tank. K^1, K^2, K^3 represent metallic sections of the commutuator mounted upon a rotating shaft shown also in figure 6. The oil has free access
54 to the interior of the commutator, and the effect of rotation is to cause the oil to be thrown radially outward between the three commutator sections shown. The effect of this oil circulation through the slots is to improve the insulation and to keep down the temperature. The oil circulates from the interior of the commutator outwardly through the radial slots and around the commutator between it and the enclosing case. The deleterious heating effects which this arrangement is designed to prevent are referred to in the specifications (page 1, line 31). The casing used to contain the oil is a completely closed casing with tight joints.

I now refer to U. S. Letters Patent 366,347, dated July 12th, 1887, to Albert Schmid. This is the patent, application for which is mentioned in the patent in suit, and in connection with the disclaimer of the patentee.

Like the patent in suit, this patent does not show anywhere spaces between the copper coil and the iron core.

Q. 6. In view of the decision of the Court of Appeals setting forth the prior state of the art, and interpreting claim 4 of the patent here sued on, what do you find is the invention as set forth in the patent in suit, and particularly pointed out in claim 4 thereof?

A. The inventor of the patent in suit was not the first to invent a transformer having open spaces in its core. Several such transformers have been referred to. The patent to Stanley, 349,616, of September 21st, 1886, in the form represented in figures 1 and 2, shows such a transformer containing such open spaces. And they are open spaces adapted to the circulation of oil throughout the entire core. Adjacent plates are separated from each other by the washers *c* shown in figure 2. Moreover, this transformer as shown in these figures, viewed from the position which show the reference letters erect, represents these open spaces in the core to be vertical, thus insuring complete circulation through the core, but there is nothing said in this patent about an oil circulation, and it has no en-
55 closing case such as will confine the non-conducting fluid. In Millar Patent the case contains oil in which are placed the transformer coils and cores, but the Court has properly found that these cores do not have open spaces in them. As is stated by the Court of Appeals, "We have then in the prior art every element of the combination claimed," but they are not put together in any one prior device. Stanley did not put his transformer into a tank of oil. If it had been so placed in his patent as former transformers like that of Millar and Brooks were placed, and for the same purpose as that which caused former inventors preceding Stanley to place their transformers in oil the Stanley device of September 21st, 1886, would necessarily have accomplished the purpose of the inventor of the patent in suit so far as the cooling of the core is concerned. This is what the inventor of the patent in suit did. He placed a trans-

former which like the prior Stanley device was constructed with open spaces in its core adapted to the circulation of a cooling medium in a case of oil like that of Thomson and Millar and Brooks, so that the oil or cooling material is confined to the enclosing case and enabled to circulate in this case about the converter.

Complainant's counsel continues the objection noted at the commencement of to-day's session, to all the testimony of the witness so far taken, on the ground that the evidence of this witness is contrary to the admissions of the answer, by which admissions the issue in this case is narrowed solely to the question whether the two devices proven to have been manufactured and sold infringe on the fourth claim of the patent. All evidence on the question of validity is inadmissible.

(The witness:) I omitted to say that the Court has taken account of all these matters presented in evidence and the ground upon which the decision was rendered is perhaps indicated in the following statement:

56 "If there is any doubt about the question of patentability, the practical and commercial results of this improvement must resolve such doubt in its favor."

The inventor of the patent in suit did not obtain a new result, but he did obtain a better result by his improved combination.

Q. 7. Bearing in mind the decision of the Court of Appeals interpreting claim 4 of the patent here in suit, and the prior state of the art, state whether you find the invention of claim 4 of the patent here in suit embodied in defendant's apparatus as disclosed by Complainant's Exhibit, Wagner Catalogue 102.

Complainant's counsel states that the Court of Appeals, to whose opinion the question refers, does not appear to have "interpreted" claim 4; for no question of infringement which called for any particular "construction" of the claim appears to have been made before that Court.

A. The Court of Appeals in its decision uses the following language:

"This claim covers such an enclosing case as will confine the non-conducting fluid, and such open spaces in the core as will permit the circulation of the liquid through them."

This language is perfectly clear and intelligible. To any one who understands what is shown in the patent drawings and described in the specifications this language must seem perfectly definite and comprehensive. I do not find the invention of claim 4 of the patent in suit in the defendant's device referred to. The defendant's device does not contain an "electric converter" constructed with open spaces in its core, as is called for in this claim here in suit.

57 This core of the patent in suit, as represented in figure 1, is composed of plates of iron, each plate of which has two rectangular holes punched through it. These holes are punched in like positions in each plate which is to compose the core. These holes register when the plates are superposed in a pile. There are, then, two rectangular holes through this pile of plates in which the

copper coils are to be placed. That pile of laminated iron is not the core of an electric converter, if these two rectangular holes, fitted to receive the copper coil, are absent. The holes referred to in the claim are not these holes, or any part of them. These holes are assumed to be present, and are covered in the words "the core of an electric converter." The open spaces in the core of this electrical converter referred to in claim 4 are the holes made by blocking the iron plates apart, as is fully described in the specifications and shown in the drawings of the patent in suit. There are no open spaces of any kind in the core of the Wagner apparatus, as shown in the Wagner bulletin referred to.

Q. 8. State whether or not you find in defendant's apparatus, as disclosed by Complainant's Exhibit Wagner Catalogue No. 102, open spaces in the core of the converter or any mechanical or electrical equivalent thereof.

A. I do not. The open rectangular channels, which are an essential element in making this a transformer core, are not wholly filled by the copper wires. The wire coils are separated from the iron core by spacing strips, and a considerable portion of the space usually occupied by the copper wire is not made use of for this purpose. There is also a space between the two groups of coils shown in this Wagner drawing. In other words a certain amount of the copper winding is left out in order to produce these channels between the coils and between the coils and the core. The primary coil is the element which receives the incoming energy from the line.
58 The secondary coil has this energy transferred to it for delivery to the secondary circuit. These coils are crippled in order to produce these ventilating or cooling channels. The effectiveness of these coils is diminished by reason of the fact that they are removed from the iron through which the inductive action is to take place. The open spaces in the core, referred to in claim 4, do not produce this deleterious result. The core of a transformer and the copper wires which carry the primary and secondary circuit perform wholly different functions and open spaces in iron cores could not possibly be the equivalent of open spaces between the primary and secondary coil or open spaces resulting from leaving out coil windings adjacent to the iron core. The patent in suit recognizes this. An open space between the primary and secondary coils is covered in claim 1. The open spaces in the iron core are not referred to in this claim. The other three claims in the patent refer to open spaces in the core and do not mention open spaces between the coils and none of these claims mention open spaces between the coils and the core because they are different from either of the others. The device of the patent in suit does not contain such openings because separation of the coil from the core was evidently not considered desirable. It is a separation of the two coils from the medium through which they are to act and react upon each other.

Adjourned until 9.30 o'clock, Saturday morning, August 8th, 1903.

Parties met pursuant to adjournment this 8th day of August, at the hour of 10:30 o'clock A. M.

Present, as before.

FRANCIS E. NIPHER (continuing):

Q. 9. Have you read and do you understand the affidavits filed with the bill of complaint herein, and
59 upon which a preliminary injunction was consented to and issued by the Court, the same constituting Defendant's Exhibit No. 2?

Complainant's counsel objects to this and all questions relating to the affidavits referred to on the ground that the same is irrelevant and immaterial at this period, and also because there is no proof of the completeness of the papers referred to. Complainant's counsel states that at the time a motion for a preliminary injunction was made complainant's counsel had no proof to connect the defendant with any infringement save that illustrated in the "American Electrician" article here in evidence, and that about April, 1903, complainant's counsel first obtained proof connecting the defendant with the other infringing apparatus—namely, in Complainant's Exhibit Defendant's Catalogue.

A. I have read the affidavits referred to and believe that I understand them.

Q. 10. Do you, or do you not find that the invention recited in claim 4 of the patent in suit, as pointed out by said affidavit differs from the invention of said claim 4 as pointed out by the depositions on behalf of the plaintiff in the Union Carbide case.

Same objection as last noted.

A. The interpretation of this claim in the depositions in the Union Carbide case made by complainant's witnesses is the same as that given in the affidavit referred to. In this affidavit Mr. Jenks refers to the article with its illustrations contained in the "American Electrician" in words, as follows:

"I have placed upon this copy the reference letter C, which indicated 'open spaces' in the core of the transformer, recited as
60 one of the elements of claim 4 of the Westinghouse patent."

In the illustration referred to in the portion of the "American Electrician," which acompanies the affidavit I find the reference letter C with reference lines drawn to spaces formed between the iron laminæ constituting the core of the transformer. These open spaces are in this apparatus formed by introducing spacing blocks between the iron laminæ. My understanding of claim 4 of the patent in suit is that it covers such a structure. The patent in suit exhibits such spaces in the iron core.

Q. 11. Please state whether or not you find in the record of the Union Carbine case, or in the said affidavits last referred to, any evidence or suggestion that by open spaces in the core was meant spaces between the coils and the core or spaces between the coils themselves.

Same objection. Complainant's counsel also objects to the question as being incompetent and calling for a conclusion of law.

A. I do not. On the contrary, the testimony all followed the obvious construction and description of the patent. In the patent spaces in the core are shown and claimed. Spaces between the coils are also shown and claimed. But these spaces are separately described and separately claimed. Spaces between the coils are not spaces in the iron core, and they are not so described or referred to, in the patent or in the depositions and affidavit referred to in the question. There is nothing whatever to indicate in the affidavits or in the depositions referred to even by the faintest suggestion that by spaces in the core was meant spaces between the coils or spaces between coils and core, and there is no suggestion of this sort in the patent in suit.

Q. 12. Have you read and do you understand British Letters Patent 9,728 of 1887 for improvements in electric converters and
61 boxes for same, the date of the application being July 12th, 1887 (the same date on which the patent here in suit was granted), and taken out as a communication from abroad by George Westinghouse, Jr., of Pittsburgh, Pennsylvania?

A. I have read the patent referred to and believe that I understand it.

Q. 13. Please state whether you find anything in the British Letters Patent referred to which throws any light on the issues now in this case and upon the contention which the complainant is now making herein—to-wit, that by open space in the core is meant open spaces between the coil and the core?

A. I think this English Patent referred to contains several passages of importance in determining what is and what is not covered by the words open spaces in the core. This English Patent is not an English reissue of the patent in suit, but is made up by combining features contained in U. S. Patent No. 366,347 to A. Schmid which was assigned to George Westinghouse and also U. S. Patent No. 428,574, to William Stanley, Jr., also assigned to George Westinghouse. This Schmid Patent to which I have referred is the one referred to on page 1, line 56 of the patent in suit. The specification of the English Patent contain paragraphs taken bodily from these two patents. Figures 1, 2 and 3 are the same figures which are marked 1, 2 and 3 in the Stanley Patent. The lettering, even, being substantially the same. Figure 6 of the English Patent is a substantial reproduction of figure 3 of the Schmid Patent. Figures 4 and 5 of this English Patent show a construction different from those shown in the Schmid and Stanley Patents referred to. In these figures the primary and secondary coils are shown separated from each other by spacing blocks or strips and both primary and secondary coils are shown separated from the iron core by strips of insulating material. There are three claims in this English Patent which refer to this latter construction. Claims 10
and 11 are of material assistance in determining the atti-
62 tude of the patentee of the patent in suit at that time on the matter inquired about. Claim 10 reads:

"10. In an electric converter, the combination with the primary and secondary coils separately wound, of plates of insulating material between the coils and strips of insulating material extending along the sides of the coils and separating the same from the surrounding core."

Claim 11 reads:

"11. The combination, in an electric converter, of a core built up of plates or sheets of soft iron, magnetically insulated from each other and having rectangular openings, primary and secondary coils within said openings, and strips of insulating substance separating the coils from the core."

It is perfectly evident that these spacing strips of insulating material which separate the coils from the core are not in either of the things which they separate. Between these spacing strips are air spaces which are also between the coils and the core. This is evident by inspection of figures 4 and 5, and claim 9 so refers to them. This claim reads:

"9. The combination, with the primary and secondary coils of a converter, separately wound and covered with insulating material, of plates of non-conducting material between said coils, strips of non-conducting material extending along the sides of the coils, and a core of soft iron surrounding the coils, leaving air spaces between said strips."

The question at issue here is somewhat like that which would be presented if a snake should wind itself around a mouse. Is the mouse then in the snake, or are the spaces between the mouse and the snake spaces in the snake? If all of the houses fronting on the four sides of a village square are combined and connected so that they form one house, is a person standing on the ground
63 in the courtyard in this house, or are spaces which separate him from the house in the house? It does not seem to me that this question admits of any discussion. The description of this structure, shown in figures 4 and 5 of the English Patent, as given in the claims quoted above, is perfectly clear and intelligible, and there is no ground whatever for thinking that the patentee of this English Patent then thought that spaces which separate two things can be in one or the other of those two things.

Defendant's counsel offers and puts in evidence drawing, referred to by the witness in answer to Question 5; the same is marked "Defendant's Exhibit No. 20, Nipher Transformer Sketch."

Defendant's counsel offers and puts in evidence the drawing referred to by the witness in answer to Question 5, in discussing the Millar Patent; the same is marked "Defendant's Exhibit No. 21, Nipher Sketch, Millar Patent."

Direct examination closed.

Cross-examination by Mr. COOPER:

X Q. 14. Are you the same Francis E. Nipher who testified as an expert for the defendant in a suit brought by the General Electric Company against the Wagner Electric Manufacturing Com-

pany, being the same defendant who is involved in this case, on the Moody Patent No. 591,869, that patent being for an air cooled transformer?

A. I am.

X Q. 15. Are you aware that the United States Circuit Court for the Southern District of New York, being the Court in which that case was tried, has decided that case against the defendant.

Objected to by defendant's counsel as not being a full statement of the facts, some of the claims sued on in that case being
64 decided in favor of the defendant and many other claims sued on having been withdrawn by the complainant.

To that complainant's counsel replies that, as a matter of fact, a decree in favor of the complainant has been entered in that case

A. I was informed that such a decision had been rendered on some of the claims sued on.

X Q. 16. Have you familiarized yourself with that decision, or have you been sufficiently informed as to its purport to know that the position taken by the Circuit Court in deciding that case was contrary to the position taken by you, as expert for the defendant, with respect to the matters adjudicated in favor of the complainant.

A. It is not my understanding that claim 4 of the patent in suit here was at issue in that case. I have not read the opinion of the Court referred to in the Moody case.

Answer objected to by counsel for complainant as not being responsive.

X Q. 17. Is that the best answer you can give to cross-question 3?

Mr. COOPER: I will repeat the question. Have you familiarized yourself with that decision, or have you been sufficiently informed as to its purport to know that the position taken by the Circuit Court in deciding that case was contrary to the position taken by you, as expert for the defendant, with respect to the matters adjudicated in favor of the complainant?

A. Having heard the question repeated I see that I did not understand your question fully. I will say in answer to the question that I do not know to what extent the decision of the Court was against the testimony I gave in that case. The claims in that case were different in character, some of them being very broad
65 and some of them being very narrow. As regards some of these claims involved in that case the defense was very strong, as regards other claims the defense was weak. It is not for me to decide that case but to give assistance, as an expert, in order that the Court might arrive at a decision. As I understand it, the Court is not bound to accept the testimony of any witness. Different people have different ideas.

X Q. 18. Is there any other prior patent which you discussed in giving your testimony here which was not before the Court of Appeals in the Union Carbide case, the record of which has been introduced in evidence in this case by the defendant?

A. I find Patent 265,936 to Thomson was not before the Court in

that case, nor was British Patent 9728 of 1887 to George Westinghouse, Jr.

X Q. 19. All the other patents to which you have referred in giving your testimony in this case were considered in the Union Carbide case referred to in X Q. 5?

A. I believe so. That is the result of my examination.

X Q. 20. Does any one of these prior patents, whether in the former record or not, when taken by itself show: (1) in combination, an electrical converter, constructed with open spaces in its core said open spaces being formed by blocking apart the core plates into groups, an enclosing case and a non-conducting fluid in said case adapted to circulate through said spaces and about the converter?

A. There is no one patent showing all of these things you have mentioned in combination. That was the finding of the Court of Appeals and that is also the result of my investigations. I do find however, and the Court of Appeals so stated, that all of these things were in the prior art. There were oil immersed transformers enclosed in cases or tanks, some for insulating the transformers, some for cooling the transformers; the transformers themselves, immersed in oil, as shown in the prior art, did not possess these same
66 features of construction as that recited in claim 4 of the patent in suit. I do not understand that the question of the anticipation of the patent here in suit is here at issue.

Counsel for complainant objects to that part of the answer of the witness commencing with the words "I do find, however," as not being responsive, and also as being argumentative and a voluntary statement on the part of the witness.

X Q. 21. Does any prior patent to which you have referred, whether in the Union Carbide record, or not, exhibit, in your opinion, when taken by itself:

(2) The combination of an electrical converter constructed with open spaces in its core, said open spaces being formed by enlarging the coil opening to a greater size than is required for the coils, an enclosing case and a non-conducting fluid in said case adapted to circulate through said spaces and about the converter?

Question objected to by counsel for defendant as being incompetent and irrelevant.

A. The question, as you put it, seems to me to involve an absurdity. It seems like asking the question whether I knew a single house built around a city square where the owner, desiring to increase the size of the courtyard within, makes open spaces in his house by building a smaller house in order that he may get a larger courtyard. I cannot see how open spaces in the core can be formed by making a smaller core. The fact that a transformer has a larger core than another does not involve open spaces in the transformer core. I do not think your question is in a form that admits of a direct answer because it involves an absurdity on its face.

X Q. 22. Your difficulty then is that my last preceding question

does not convey to your mind a clear idea of a definite construction.

67 A. I think I have an idea of the construction you perhaps refer to. I have indicated what I thought it was by reference to the building surrounding the courtyard. The question as it is put describes a construction in language to which I object and to which I cannot give assent.

Counsel for complainant here states that he is unable to finish the cross-examination of this witness at this time; that defendant's counsel has stated on the record that it is his intention to have a half holiday to-day, this being Saturday, and that he does not intend to proceed with the taking of the depositions this afternoon; that he has stated off the record that he has at least one other witness, and possibly two, whom he wishes to examine, and that one of said witnesses is not in the city. Counsel for complainant states, for reasons already entered upon this record, that it is wholly impossible for him to be here in St. Louis on Monday the 10th instant. He, therefore, requests that an adjournment be taken until August 14th, being the earliest date on which he can possibly be in St. Louis.

Counsel for defendant, in reply to the statement of counsel for complainant, says that his time for taking depositions in this case has been limited to August 15th, 1903, on motion of complainant, and that he protests against an adjournment to August 14th, and insists that he has a right to proceed with the taking of his testimony on Monday, August 10th, 1903, and thinks he can complete the taking of his testimony on behalf of the defendant by Monday night; that he thinks it is absurd for counsel for complainant to come here from New York for a day and a half and expect to have these depositions closed by that time; that it is the invariable

68 custom of this office, as well as other offices here in St. Louis, to have a half holiday Saturday afternoon during the hot summer months, and that it is now twelve o'clock.

Counsel for complainant states that, in view of all that has transpired in this case during the last two days, he is willing to make this concession: That defendant's counsel proceed on Monday next to take the testimony-in-chief of such other witnesses as he may have to examine, and for that purpose an adjournment now be taken to Monday, the 10th day of August, 1903, at 10:30 o'clock A. M.; that the right of objection and cross-examination be reserved by counsel for complainant (including the witness now under examination), and that he will proceed on August 14th and 15th to cross-examine the witnesses to be examined in chief by counsel for defendant.

Counsel — defendant states that he is willing to accept the suggestion made by counsel for complainant, and states that he will proceed on Monday to examine his remaining witnesses and finish as shortly thereafter as possible, the right to appear and cross-examine on August 14th and 15th being reserved to counsel for complainant.

An adjournment was thereupon taken to Monday, August 10th, 1903, and the hour of 10:30 o'clock A. M.

ST. LOUIS, MONDAY, *August 10th*, 1903.

Parties met pursuant to adjournment this 10th day of August, 1903, at the hour of 10:30 o'clock A. M.

Present—Mr. Babbitt, for complainant; Mr. Fowler, for defendant.

The witness, Francis E. Nipher, being present, stated that
69 he wished the record to show that, owing to the fact that Mr. Cooper, counsel for complainant, was compelled to leave hurriedly on Saturday to take a train for New York, that he, the witness, was unable to complete his answer to the last question propounded by Mr. Cooper, and that when he appeared on Friday, August 14th, for further cross-examination he would ask to be allowed to complete his answer to said question.

Mr. Fowler, counsel for defendant, stated that the witness he expected to have present at this session would not be able to be present until 2:30 o'clock this afternoon, and requested that a recess be taken until that hour, which was accordingly done.

NOTE.—The continuation of F. E. Nipher's deposition will be found on page 88.

Parties met at 2:30 P. M., this 10th day of August, 1903, when the following proceedings were had.

Present—Same as last noted.

Deposition of George E. Wells.

GEORGE E. WELLS, a witness of lawful age, being produced, sworn and examined, in answer to the questions propounded to him by counsel for defendant, deposes and says as follows:

Direct examination by Mr. A. C. FOWLER:

Q. 1. State your name, age, residence and occupation?

A. My name is George E. Wells. I am 28 years of age. My occupation is that of a consulting electrical and mechanical engineer.

70 Q. 2. With what firm or concern are you connected?

A. I am a member of the firm of Ruebel, Schweidtman & Wells, consulting engineers, having offices in the Chemical Building, St. Louis.

Q. 3. Where were you employed during the year 1899 and in what capacity.

A. I was in the employ of the Wagner Electric Manufacturing Company in the capacity of an expert engineer.

Q. 4. What sort of an engineer?

A. I was engaged in designing, constructing and erecting switchboards and transformers.

Q. 5. How long were you employed by the Wagner Electric Manufacturing Company in that capacity and when did you sever your connection with that company?

A. I was employed by that company from September, 1898, to July, 1901.

Q. 6. Are you familiar with the line of transformers manufactured by the Wagner Electric Manufacturing Company, the defendant in this suit, during the time you were employed by them?

A. I am.

Q. 7. Please look at Wagner Catalogue No. 102, being Defendant's Exhibit No. 3, said catalogue being dated 1901, and state if you recognize the same, and, if so, tell us what it is.

A. I recognize the catalogue referred to as a bulletin issued by the Wagner Electric Manufacturing Company, giving a general description of their transformers as they were making them at that time.

The cut on the front cover of the catalogue was taken from an actual photograph which I personally arranged. I believe that the other cuts were taken from photographs of transformers, and that they represent the construction of defendant's transformers at that time.

Q. 8. State when, or about when, this catalogue was issued by the defendant company.

71 A. That catalogue was issued by the defendant just before I left their employ. I left in July, 1901, and, as near as I can recall now, that catalogue was issued by the Wagner Company in June, 1901.

Q. 9. Do you recognize the transformer illustrated on the upper half of page 10 of this catalogue, and, if so, please state the facts, and also how such transformers were constructed.

A. I recognize the illustration referred to. That illustration was made from a drawing and was intended to illustrate in detail the method of spacing between the copper coils and the iron core so as to allow for the circulation of oil between the copper coils and the iron core.

Q. 10. How long, to your knowledge, has the defendant the Wagner Electric Manufacturing Company been manufacturing and selling such transformers—that is to say, transformers constructed with spaces between the coils and between the coils and the core, adapted for the circulation of oil between such spaces.

A. To the best of my knowledge the Wagner Electric Manufacturing Company were making transformers in this manner at the time I was first employed by them, in September, 1898.

In the summer of 1900, while I was in Montreal, Canada, I took apart a number of Wagner transformers for the purpose of inspecting and repairing them and found a great many of these transformers which had been in use, in the City of Montreal, Canada, prior to that date, constructed with spacing strips between the copper coils and between the copper coils and the iron core.

Q. 11. Where had these transformers been manufactured?

A. I have every reason to believe that they were made in St. Louis by the defendant company.

Q. 12. Were these catalogues of the Wagner Company, to which I have referred, being Defendant's Exhibit No. 3, for private use or for public distribution.

A. They were for public distribution.

72 Q. 13. How were they distributed to the public?

A. To the best of my knowledge they were distributed to the public through the agents of the company.

Q. 14. Are you familiar with the Wagner transformers which were in use at the works of the Union Carbide Company at Niagara Falls, New York. If so, are you able to state whether or not said transformers had open spaces between the coils and between the coils and the core adapted for the circulation of oil?

A. Those transformers, as originally constructed, were insulated between the coils and between the coils and the core, by winding a heavy cord completely around the outside of each coil. This was designed to produce an opening between the coils and between the coils and the core for the circulation of oil.

In November, 1901, three of the transformers referred to were ordered reconstructed and were as a matter of fact, reconstructed shortly thereafter. The first one of these transformers which was reconstructed was reconstructed under my direction at the works of the Union Carbide Company. This transformer was reconstructed with spacing strips between the separate coils and between the coils and the iron core. The other two transformers which were reconstructed here in St. Louis and sent to the Union Carbide Company at Niagara Falls, practically complete and ready for service.

Q. 15. Were the transformers in the Union Carbide Works, which you say you reconstructed by placing spacing strips between the coils and the core provided with open spaces between the coils themselves and between the coils and the core?

A. They were provided with such open spaces.

Q. 16. After the Court of Appeals sustained the 4th claim of the Westinghouse Patent here in suit, were you instructed to make any changes in the Wagner transformers at the Union Carbide Company's Works, and if so, state what changes you made in said transformers.

73 A. In June, 1902, I was instructed by the Wagner Electric Manufacturing Company to go to Niagara Falls and make certain tests on one of the transformers. I was instructed to choose one of the transformers which was first installed. The object of this test was to determine if the temperature of the windings of the transformer would be affected by removing the spacing strips which had been inserted in order to secure a circulation of oil in the core. I refer to the spacing strips which had been inserted between the plates composing the iron core. I succeeded in making a complete temperature test on one of these transformers, testing the same with the spacing strips in position, between the plates of the iron core and also testing the transformer after the spacing strips had been removed from between the plates composing the iron core.

Q. 17. Did you make any other changes in those Wagner transformers at the Union Carbide Works?

A. I did not.

Q 18. Are you able to state whether those transformers at the Union Carbide Works had open spaces between the coils and the

core and between the coils themselves adapted for the circulation of oil?

A. They had such spaces.

Q. 18. Are you able to state whether those transformers at the Union Carbide Works were afterwards changed by replacing or rather changing the transformers, so that the laminæ of the core was bolted solidly together?

A. Three of the transformers were replaced by transformers having the laminæ of the core bolted solidly together.

Q. 20. In those three transformers were there open spaces between the coils themselves and between the coils and the core adapted for the circulation of oil?

A. There were.

Q. 21. When was this done, Mr. Wells?

A. After the tests which I have described in answer to one of your former questions, were made by me, the transformers
74 which were made after that date were made or built so that the iron laminæ composing the core were bolted solidly together, but there still remained open spaces between the copper coils and between the coils and the core.

Q. 22. Do you know of any other changes having been made by any one, at any time, in these Wagner transformers in the Union Carbide Works, except that of bolting the laminæ of the core solidly together, after the 4th claim of the patent in suit was sustained by the Court of Appeals in the spring of 1902?

A. Changes were made in the construction of the last transformers installed there other than merely bolting the laminæ together.

Q. 23. What were those changes, Mr. Wells?

A. The windings were changed and the dimensions of the iron core were changed.

Q. 24. Will you please state what was the construction of these Wagner transformers that were placed in the works of the Union Carbide Company, after the spring of 1902 with respect to having, or not having, spaces between the coils themselves and between the coils and the core, and also with respect to having spaces between the laminæ of the core?

A. Those transformers all had spaces between the copper coils themselves and between the coils and the core, but they had no spaces whatever between the laminæ composing the core. The laminæ composing the core was bolted solidly together.

Q. 25. Were, or were not, those spaces between the coils themselves and between the coils and the core adapted for the circulation of oil?

A. Those spaces between the coils and between the coils and the core were adapted for the circulation of oil.

Q. 26. But I understand you to say that the laminæ of the core itself were bolted solidly together so as to leave no open spaces in the core?

A. That is what I stated.

75 Q. 27. Was, or was not, each of these transformers enclosed in a case?

A. Yes, sir, each transformer was enclosed in a case.

Q. 28. Have you any connection at the present time with the defendant the Wagner Electric Manufacturing Company?

A. I have no connection with the defendant company.

Direct examination closed.

GEORGE E. WELLS.

Subscribed to and sworn to before me this twelfth day of August, 1903.

JAMES R. GRAY,
Standing Examiner.

Mr. Fowler, counsel for defendant, states that he is informed by the witness, Mr. Wells, that he (Mr. Wells) has made arrangements to go to Oklahoma and Texas on Wednesday, and expects to be absent some ten days; that he regrets that counsel for complainant, Mr. D. W. Cooper, did not remain here to conduct the cross-examination of this witness now; that he will endeavor to produce the witness here on the 14th or 15th, at which time Mr. Cooper stated he would be here, so as to enable Mr. Cooper to cross-examine him; but that the witness is not in the employ of the defendant company and not under their control, and, if he leaves the city at the time mention, it will be impossible to have him back here on the 14th or 15th.

Mr. Babbitt, representing the complainant here, states that he wishes to reserve the right to cross-examine this witness until such time as Mr. Cooper can return to St. Louis for that purpose.

Mr. Fowler stated that the other witness, Mr. W. A. Layman, had not yet returned, but was expected back tomorrow morn-
76 ing, and, therefore, requested that an adjournment be taken until 2:30 o'clock tomorrow, August 11th, at which time he expected to complete the examination of Mr. Layman.

An adjournment is here taken until 2:30 P. M., Tuesday, August 11th, 1903.

Parties met pursuant to adjournment this 11th day of August, 1903, at the hour of 2:30 o'clock P. M.

Present, as before.

Deposition of W. A. Layman.

W. A. LAYMAN, a witness of lawful age, being called and sworn on the part of the defendant, deposes and says as follows:

Direct examination by Mr. FOWLER:

Q. 1. State your name, age, residence and occupation?

A. My name is W. A. Layman. I am 34 years of age. I reside in St. Louis, Mo. I am manager and treasurer of the Wagner Electric Manufacturing Company.

Q. 2. How long have you been connected with the Wagner Elec-

tric Manufacturing Company, the defendant in this case, and in what capacities?

A. I have been connected with that company since September, 1892, in the several capacities, successively, of draughtsman, testing-engineer, assistant superintendent, assistant manager and my present position of manager and treasurer.

Q. 3. Are you familiar with the line of transformers that have been manufactured by the Wagner Electric Manufacturing
77 Company since you have been connected with that company?

A. I am.

Q. 4. Please look at the catalogue which I now hand you, the same being marked "Defendant's Exhibit No. 3," and state what it said and when it was issued?

A. This is a catalogue that was issued by the Wagner Electric Manufacturing Company and is one of that company's regular advertising circulars. It was issued early in the year 1901, and is descriptive of what the company has termed its line of standard lighting-motors and transformers.

Q. 5. About how many of those circulars were distributed to the public and about when were they so distributed?

A. Not less than 5,000 copies of this particular circular were distributed broadcast throughout the United States. It is our practice to send copies of circulars such as this to each central lighting station and also to a long list of consulting engineers and other individuals particularly interested in this line of apparatus. This particular circular, or the first edition of it, was in constant circulation for about two years. A surplus supply was always kept on hand and mailed to inquiring individuals.

Q. 6. Please look at the transformer illustrated on the upper half of page 10 of this circular, defendant's exhibit No. 3, and state if you know what it is. In that connection I will get you to state the construction of this apparatus as to whether or not it had any spaces between the coils themselves and between the coils and the core adopted for the circulation of oil.

A. The illustration on page 10, to which you refer, shows a sectional view of this line of standard transformers, and the purpose of this particular cut was to show clearly, to a prospective customer the ample provision made for the free circulation of oil between the coils of the transformer, and between the coils and the core.
78 On page 4 of this circular the advantages of this spacing, as shown on page 10, are referred to in the following language:

"The cross section of the 15 kilowatt transformer, on page 10, illustrates very clearly the excellent provision that has been made for cooling the primary and secondary coils, and iron, by keeping up a natural circulation of oil. This is one of the most important advantages of the shell type transformer. These oil ducts are so proportioned and so placed that, while they keep all parts of the transformer cool and thus prevent deterioration of insulation and reduce ageing of iron to a minimum, they cause a minimum loss of efficiency."

In exploiting the sale of this apparatus it has been the custom of

the company to lay particular stress on this provision made by means of spaces between the coils and between the coils and the core, for keeping the coils cool.

Q. 7. Has the transformer any open spaces in the core?

A. This particular transformer has not. In fact it has not been the practice of the company to use spaces in the core in small transformers.

Q. 8. How long, to your knowledge, has the Wagner Company been manufacturing oil cooled transformers having spaces between the coils themselves and between the coils and the core for the circulation of oil?

A. About 8 or 10 years. It always has been the practice of the company to use such spaces in transformers of the larger size, by larger size I mean units of 25 kilowatt or more capacity; also to use such spaces in transformers wound for high voltage, the object of the spaces in transformers wound for high voltage being both to cool the coils and also to assist in the insulation of the coils.

To my knowledge it has been the practice for 10 years or more for all builders of oil filled transformers to make use of spaces
79 between the individual coils and between the coils and the core.

Q. 9. Has the Wagner Company at any time during these 10 years discontinued the manufacture and sale of such transformers?

A. They have not.

Q. 10. Prior to the publication of this circular advertisement, Defendant's Exhibit No. 3, in 1901, were any circulars issued by the company, the Wagner Electric Manufacturing Company, I mean, showing or describing oil filled transformers having spaces between the coils and the core and between the coils themselves adapted for the circulation of oil?

A. The only other circular that I have in mind at the present moment is bulletin No. 9, issued by the Wagner Electric Manufacturing Company in December, 1897, a copy of which I herewith produce. On page 45 of this bulletin, figure 41, is shown a transformer thus constructed.

Q. 11. How many of these bulletins like bulletin No. 9 which you have just produced were issued and distributed to the public by the Wagner Electric Manufacturing Company?

A. Not less than 3,000 and probably as many as 5,000. It was the custom of the company to print from three to five thousand copies of each of such circulars.

Q. 12. About when were the bulletins like No. 9, to which we have been referring distributed to the public by the Wagner Electric Manufacturing Company?

A. About December, 1897.

Counsel for defendant here offers in evidence bulletin No. 9 of the Wagner Electric Manufacturing Company, identified by the witness, and the same is marked "Defendant's Exhibit No. 23, Wagner Bulletin No. 9."

Q. 13. Are you familiar with the litigation which has been had

between the Westinghouse Electric Company and the Union
80 Carbide Company, on the patents here in suit?

A. I am familiar with that litigation. I have actively represented the Wagner Company in cooperating with counsel in the defense of that litigation.

Q. 14. Have you read the printed record in that case?

A. I have.

Q. 15. Have you read the opinion of the Court of Appeals for the Second Circuit, sustaining the 4th claim of the patent here in suit?

A. I have read the opinion referred to.

Q. 16. Have you found in that record or in that opinion any suggestion that, by open spaces in the core was meant open spaces between the coils themselves or between the coils and the core?

A. I have followed this entire litigation very closely. I have had frequent consultations with counsel in the preparation of the defense and in the preparation of the argument. I was present in the Court of Appeals when oral argument was made in the case referred to. I have also many times discussed with counsel for the defense means to be employed by the Wagner Company in modifying apparatus in event of an adverse decision, so as to free the transformers made by the Wagner Company from the terms of claim 4 of this patent here in suit. Throughout that litigation the idea was at no time suggested to me that the complainant in the Union Carbide case contemplated construing the language of claim 4 to include spaces between the coils and spaces between the coils and the core. Furthermore, the language of this claim did not at any time suggest to me the idea that it was the intention of the inventor to have this claim refer to anything besides spaces in the core itself.

I can positively assert that at no time since the inception of this litigation has any party or engineer connected with the staff of the Wagner Electric Manufacturing Company had the least sus-
81 picion that spaces between the coils and between the coils and the core were in any way connected, or rather involved, in that litigation.

I may also state further that we have never received from the Westinghouse Company, either through counsel or through direct channel, any complaint that our transformers, constructed with open spaces between the coils and between the coils and the core, infringed this or any other patent they owned or controlled.

Q. 17. Are you familiar with the construction of the Wagner transformers which were furnished to the Union Carbide Company, which were the transformers involved in the suit brought by the complainant in this case against the Union Carbide Company?

A. I am.

Q. 18. Will you please describe the construction of the transformers furnished by the Wagner Company to the Union Carbide Company, being the transformers involved in that litigation?

A. Those transformers were of the well-known shell type of construction. The individual coils were grouped so as to provide spaces between their several parts, and after being so grouped they

were surrounded by a core, provision also being made for spaces between the coils and the core. The object of these two sets of spaces, namely, the spaces between the coils themselves and between the coils and the core being to permit the free circulation of oil about all of the windings. The transformers referred to when first constructed had open spaces in the core. These open spaces in the core were formed by the separation of the plates constituting the core into groups. This separation was accomplished by the means of small fiber blocks driven into the core at intervals of four or five inches along the vertical dimension. These spaces in the core, formed by means of these fiber blocks, were the subject of the litigation in the case of the Westinghouse Company, the complainant in this suit, against the Union Carbide Company. The decision of the Court in that case compelled the defendant to either remove those spaces or discontinue the use of the
82 transformers entirely. By removing the spaces in the core, I mean withdrawing the spacing blocks and closing up the spaces in the core.

The Wagner Company, by virtue of its relation to the defendant in that case, undertook to modify the transformers so as to remove them from the infringement of the fourth claim of the patent in suit. Immediately after the decision of the Court of Appeals the spacing strips in the core of those transformers in actual service were removed.

Q. 19. Are you able to state whether there was any change made in these transformers in the way of removing the spaces between the coil and the core and between the coils themselves?

A. The spaces between the coils and between the coils and the core were not removed from those transformers. The transformers as in operation today, are in that respect identical with the transformers as originally sent out by the Wagner Company to the Union Carbide Company.

Q. 20. Am I right in supposing that those transformers were oil-filled transformers?

A. They were. They were of the oil-filled type.

Q. 21. Since the decision of the Court of Appeals sustaining the 4th claim of the patent here in suit has the Wagner Company made or sold transformers having open spaces in the core?

A. They have not. We have been guided by instructions of counsel in this matter and have fully complied with the requirements of that decision.

Q. 22. Were you advised by counsel at the time application was made for a preliminary injunction, in this case, against the Wagner Company, and were you consulted with regard thereto and are you conversant with these proceedings?

A. The matter of preliminary injunction was freely discussed by me with counsel of the Wagner Company. We were informed by counsel that we could consent to a preliminary injunction and continue the manufacture of transformers by avoiding
83 entirely the use of spacing strips in the core. On being so advised, we authorized counsel to consent to the preliminary injunction.

Q. 23. At the time the preliminary injunction was consented to was there anything said, or was it your understanding, that by open spaces in the core was meant open spaces between the coils and between the coils and the core?

A. At no time was our attention in any way directed to the question of spaces between the coils and between the coils and the core. On the contrary, our whole attention was directed to the question of the spaces in the core. I am perfectly satisfied that there was, in the mind of our counsel, absolutely no contemplation that claim 4 referred in any sense to spaces other than spaces in the core itself.

Q. 24. My question may, perhaps, call for a repetition of some of your previous testimony, but I will get you to state now whether, since the decision of the Court of Appeals sustaining the 4th claim of the patent here in suit and since the issuance of the preliminary injunction herein, has the Wagner Company discontinued making and selling transformers having open spaces between the coils and between the coils and the core?

A. The Wagner Company has at no time discontinued the manufacture and sale of transformers having open spaces between the coils and between the coils and the core. On the contrary, they have been building transformers right along since the decision of the Court of Appeals in the Carbide case and since the preliminary injunction was issued in this case, embracing the features mentioned that is, open spaces between the coils and between the coils and the core.

Q. 25. How many transformers were furnished to the Union Carbide Company by the Wagner Company?

A. We supplied the Union Carbide Company with seven transformers of 2,000 horse-power capacity each, and two or three of 500 horse-power capacity each.

Q. 26. Can you state whether or not all the transformers
84 have been changed by removing the open spaces in the core?

A. Three of the 2,000 horse-power and all of the 500 horse-power transformers have been so changed. The remaining four of the 2,000 horse-power transformers have not been in service at any time since the decision of the Court of Appeals, and, therefore, no immediate necessity existed for changing them. The Union Carbide Company now desires them for service, and the Wagner Company is at this time proceeding with the modification of the remaining four.

Q. 27. You may state exactly what changes you are now making in the four transformers refer-ed to in your last answer.

A. We are making two changes. The first change is to free the transformers from the decision of the Court of Appeals, and the second change is for the purpose of providing a different secondary pressure. The first change consists in removing the fiber blocks which were originally driven into the core, and, after their removal, to tighten up the plates of the iron core. This process removes the spaces in the core. The second change is a change—was

made necessary by a change in the method of using the transformer, and has nothing whatever to do with the decision of the Court of Appeals. The change last referred to simply consists of changing the copper coils so as to provide a different number of effective secondary turns, and thus permit the carbide company to use the transformer at a secondary voltage of 90 instead of a secondary voltage of 110, as was made necessary in the original transformer. We happen to be making the two changes at the same time merely as a matter of convenience.

Q. 28. Are you making any changes in these transformers of the Union Carbide Company with respect to open spaces between the coils and between the coils and the core?

A. No, sir. The original space between the coils and the core and between the coils are being carefully retained in the
85 modified apparatus.

Q. 29. What do I understand you to mean by the core of an electrical transformer?

A. The core of a transformer is the iron part of the transformer. In transformers as now generally constructed this core is built up of plates. These plates are generally of a rectangular shape. The first electrical transformer builders employed cores which were straight bundles of iron wire. You might regard a lead pencil as a good example of one of the original transformer cores. The coils were wound around these cores, which in the original transformers were bundles of straight iron wire just like you would wind a piece of twine around a lead pencil, there being in this early transformer two distinct coils, one for the primary and one for the secondary. It was soon found that these transformers would be more efficient if after the coils were wound on the ends of the core the ends were brought around into metallic contact. The next advance was to first make up a core in the shape of a ring of iron wire and then use a bobbin as a matter of convenience, to wind the wire by hand around the ring. The next step taken, as a matter of convenience and economy was to substitute a ring of iron punchings for the ring of iron wire. These punchings were made with cuts across them so the ends of the core plates could be opened up and coils slipped over the open ends, the cores, or rather the ends of the core, being again brought down so that the core was in the shape of a ring. From this form of construction there was a gradual transition until the core finally assumed the form such as is shown by the Westinghouse Patent in suit. This core as now used may be regarded as the equivalent of two bundles of iron wire passed up between the coils, as shown in figure 1, and the ends of these two bundles of wire then being bent around in opposite direction until they met, thus forming a closed iron core, as in figure 1.

Both as an engineer and as the commercial representative of a transformer company, I can state that the iron core of the
86 transformer is now and always has been merely the useful iron of the transformer. The term "core" does not embrace any spaces outside of the iron whatever, and is essentially limited to the iron. Therefore, any rectangular openings which

happen to be created in the ring core, for example, by bending the ends of the pencil around into metallic contact would not in any sense be spaces in the core itself.

Direct examination closed.

At this stage of the proceedings an adjournment was taken, by consent of counsel, to Friday, August 14th, at 10:30 o'clock a. m.

NOTE.—The continuation of W. A. Layman's deposition will be found at page 107.

Parties met pursuant to adjournment this 14th day of August, 1903.

Present: J. H. Bryson, Esq., for defendant; D. W. Cooper, Esq., for complainant.

Counsel for complainant requests counsel for defendant to state whether he intends to produce for cross-examination, today or tomorrow, all of the witnesses whose examination in chief has been taken in accordance with the agreement entered upon the record at the close of the session held on August 8th, 1903; complainant's counsel states that he asks this question because he is informed that defendant's counsel on the afternoon of August 10th examined the witness George Wells, knowing at the time that the said witness did not desire to be present either today or tomorrow,
87 but wished to go beyond the jurisdiction of the Court and remain there, and that with the deliberate intention of breaking his agreement with complainant's counsel by permitting the witness to absent himself from the jurisdiction today and tomorrow, defendant's counsel not only failed to subpœna Wells to be present at the time appointed for cross-examination, but arbitrarily directed the witness to sign his deposition thereby closing it.

Counsel for defendant responds that said witness Wells will return to St. Louis in about ten days and that he is willing upon the return of said witness to submit said witness for examination in St. Louis where counsel for complainant resides; that he is willing to submit this witness for cross-examination at any time after his return and before proofs in this case are finally closed and that complainant may proceed with its testimony in rebuttal without delaying for the cross-examination of this witness.

Complainant's counsel declines to accede to any such proposition for the reason that it is unfair to ask him, after he has already made two trips to St. Louis to attend the taking of defendant's testimony, to return a third time, particularly under the circumstances heretofore noted; further than this the defendant's time for taking testimony is limited by order of Court to expire on August 15th and it was within defendant's power to compel the attendance of the witness as counsel for defendant agreed to, at this present session. Further than this the deposition of the witness has been closed by the appending of his

signature; which is in earnest of the intention of defendant's counsel to cut off the right of cross-examination.

88 Complainant's counsel gives notice that he will, at or before the hearing of this cause, make a motion to strike the deposition of the witness Wells from the record in this case for the reasons which have heretofore been noted.

Counsel for defendant replies that he has offered to reopen the deposition of the witness for cross-examination; that the fact that complainant's counsel was compelled to make two trips to St. Louis instead of one is not the fault of counsel for defendant, but was due to complainant's counsel's professional engagements, and that had it not been for such engagements, the witness Wells could have been cross-examined at the close of his direct examination.

Complainant's counsel does not assent to the foregoing statement; the facts regarding his attendance are set forth in the statements of counsel made at the beginning of the session of August 7th and at the end of the session of August 8th.

Continuation of Deposition of F. E. Nipher.

NOTE.—The preceding portion of this deposition will be found at page 34.

FRANCIS E. NIPHER, in continuation of his answer to cross-question 22, further deposes and says as follows:

I can, perhaps, make this matter clear by reference to earlier forms of the electric transformer.

Faraday made the first transformer, using an iron ring as the core of his primary and secondary wire. The earliest form that was applied to useful purposes was one in which the core consisted of a bundle of iron wires, the lamination being secured by using the iron in the form of wire. The primary and secondary coils were coaxially wound upon this straight bundle of iron wire. I have

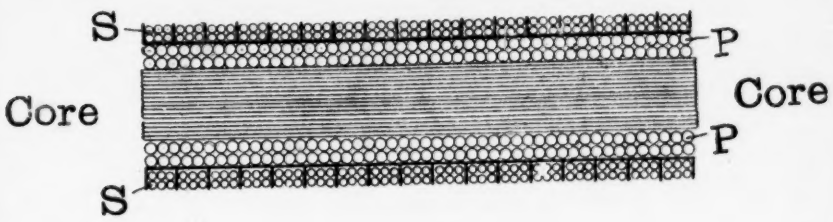
(Here follows diagram marked p. 88*a*.)

89 here a sketch showing this construction, and it is indicated on the sheet by the reference letter A. The primary and secondary coils are represented by the letters P and S.

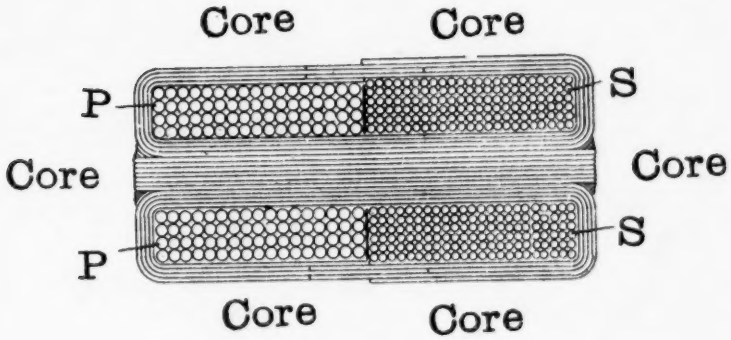
It was found later that effectiveness of this converter could be increased by making the iron core much longer than the coils, so that the separate wires of the core could be bent back around the copper coils, forming thus a complete iron circuit for the magnetic field. In this construction the two ends of the iron core were united by the overlapping wires. This was a return to Faraday's form of converter, with the additional improvement of a laminated core. This construction is represented on the same sheet as the sketch just referred

Defendant's Exhibit No. 24,
Nipher Sketch, Transformer Evolution.

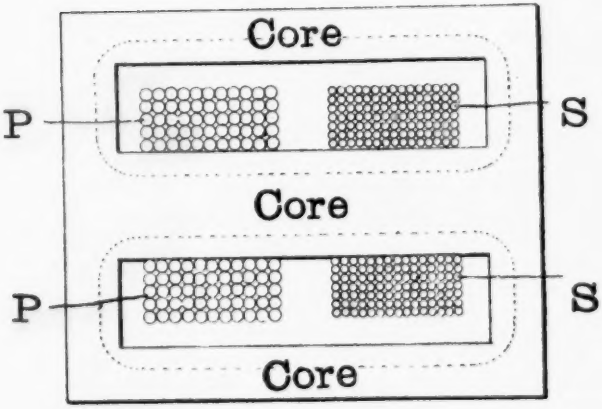
A



B



C



No. 179-
Westinghouse Co
Wagner Co.

to, being indicated by the reference letter B. In this arrangement the coils may be wound co-axially as before, or they may be wound in sections, as in fact had been done with type A before mentioned. A more mechanical arrangement was soon hit upon in which the iron core was built up of iron plates, which furnished all needed lamination. These plates were laid in a pile, holes punched through the plates, being made to register, thus forming rectangular channels in which the copper wire was wound. This type is represented on the same sheet, the reference letter C indicating this type. Types A and C are both very much in use at the present time.

The effectiveness of any core is determined by the area of the cross-section of the iron which runs through the two coils. In types B and C the cross-section of the central part of the core should be the same as that of the return iron circuit which leads to magnetic field from the central core around the two coils and back to the other end of the central core. With this arrangement the copper coils link with the iron core, both being in closed circuit.

The question is now how can open spaces be made in the iron core? In types A and B where wire is used such spaces might be formed and rendered effective for circulation by inserting spacing blocks between the iron wires, these spacing blocks being perforated.
90 Short pieces of hollow tubing would accomplish the purpose, the tubing being usually of insulating material. In type C which is that of the patent in suit the same thing could be accomplished by blocking the plates apart. This is what is shown in figure 2 of the patent in suit, and this is what is referred to in claim 4 of that patent.

How can open spaces be made between the coils and the core. In type A this is accomplished by winding the copper wires in coils upon a form larger than the core slipping these coils over the core and holding them in position there by spacing strips running parallel to the core. This forms ventilating channels between the coils and the core. In type B the same thing can be done, but it might then be necessary to make the core longer in order that individual wire may then overlap when they are bent back around the copper coils. The amount of lengthening of the iron core would of course depend upon the amount of spacing desired and whether this spacing was to entirely separate the iron from the copper or only in part. In type C the same conditions hold. The individual plates of the transformer must be punched from a larger sheet of iron if there is to be space between the iron core and the copper coils. This is, in effect, increasing the length of the iron circuit. The spacing so formed is not spacing in the iron core, but it is spacing between the coil and the core. If we were talking about a water pipe we would say that the water is in the pipe. It is the space within the inner surface of the pipe that is effective in transporting water, but when a tubular piece of iron or of copper is used for carrying, in the one case, a magnetic field, in the other case an electric current, it is the cross-section of the metal which does the work, and the capacity of the conductor or the iron core is determined by the net area of the cross-section of the metal. In order to make open spaces in such conductors those spaces must be in the metal conductors and not by the

side of them. If you bore out such an iron pipe you in-
91 crease its capacity as a pipe but you diminish its capacity as a conductor for a magnetic field. These physical essentials are well understood, and the common and accepted use of the word "in," as applied to an iron water pipe and to the iron core of a transformer takes note of these physical fundamentals, precisely as in the case of a house built around a square of a city, as I have before mentioned. If such a house, put up on a building line and enclosing a court-yard, were to burn down, and another were to be erected with a larger courtyard this would mean that part of the space formerly in the house is now in the court-yard and not in the house. The house is smaller than before, because some of its rooms must be small or some of them must be omitted.

This is exactly the case in this transformer referred to in the question. You cannot make open spaces in the core by enlarging the coil openings.

Complainant's counsel objects to the foregoing statement as wholly inresponsive to the question asked and as argumentative.

Counsel for defendant offers and puts in evidence the sketch referred to by the witness in his last answer, and requests that the same be marked "Defendant's Exhibit No. 24, Nipher Sketch, Transformer Evolution."

Complainant's counsel objects to the foregoing offer and to the exhibit as irrelevant and immaterial.

23 X Q. I hand you herewith a sketch which, for convenience of

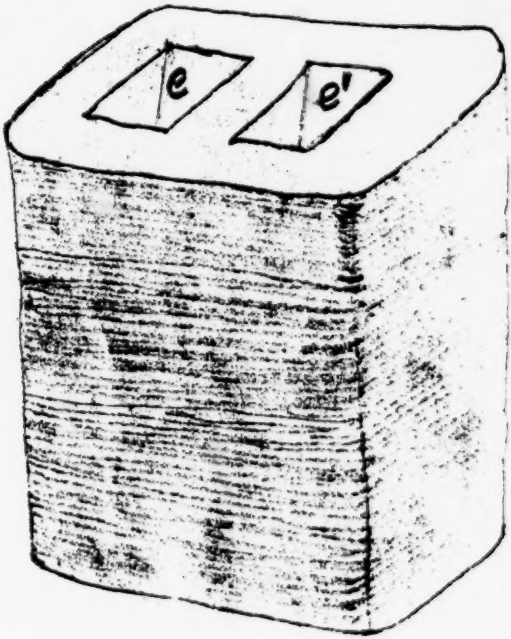
(Here follows diagram marked p. 90*a*.)

reference, I will mark "Complainant's Exhibit Sketch, Nipher, X Q. 10," and which may be taken to represent a double-barreled oil conduit, formed, if you please, of a series of perforated iron plates, fastened together sufficiently closely for the purpose, and so that the perforations register to form two ducts, e and e^1. As this
92 structure stands, is it not true that the bounding surfaces of the holes e and e^1 are the interior surfaces of the oil conduit?

A. I understand that this arrangement is a device for piping oil. The iron walls bounding these rectangular-cylindrical holes are the walls of a pipe. The inner surfaces of the pipe are the interior surfaces of the pipe or conduit. If such a structure were to be described as a well-known structure to be used as the iron core of a transformer, and if an inventor wished to locate in this well-known structure certain open spaces which had not been there before he would necessarily use language in the ordinary sense in which it is understood. As I have stated before, "in a pipe" is in the space through which the liquid conduction takes place and the same things is true of the

OA

Complainant's Exhibit
Ketch Siphon XQ. 10
August 14, 1903 J.R.G. Ex.



No. 179.
Westinghouse Co
Wagner Ex

iron core of the transformer where magnetic connections takes place. The iron, and not the space, is the conductor.

Complainant's counsel offers in evidence the sketch shown the witness and the same is marked "Complainant's Exhibit Sketch Nipher, X Q. 10, August 14th, 1903, J. R. G., Exr."

24 X Q. Still considering the sketch and regarding the device shown there as an oil conduit are not the openings e e^1 oil ducts and their bounding surfaces the internal surfaces of the structure, using language in it's ordinary sense?

A. I only know what the openings e e^1 are from your statement. If they are oil ducts, merely, and are to be used only for oil transmission, as pipes, then it would be proper to say that these surfaces are the inner surfaces of the pipe. In a geometrical sense, also, if we were to consider this as a geometrical form simply, it would be proper to refer to these surfaces as internal surfaces. But this figure appears very much like a well-known form given to the iron core of a transformer, and if it is such an iron core, then I should say that everything geometrically inside of these surfaces is outside of
93 the core. This is just as true in this case, which represents type C referred to in Exhibit No. 24, as in types B and A of that sketch. The whole question at issue here seems to me to resolve itself into a pun on the word "in."

All that part of the foregoing answer commencing with the words "But this figure" objected to as argumentative and volunteered.

25 X Q. Well, consider, if you please, the figure of the sketch Nipher X-Q. 10 to represent the core of an otherwise unassembled transformer. The holes e e^1 are what the patent in suit describes (page 1, line 42) as "two rectangular openings," are they not?

A. As a matter of fact, this core is never assembled in that way. The coils are put in place and held in position and the plates are then assembled singly in position around these coils, and when this is done this core is the core of a transformer and these openings referred to are occupied by the copper coils, and such spacing is left between and round the coils as may be needed. I think there is no doubt that the openings shown in the sketch are rectangular. When this care is made the core of a transformer by placing it around the copper coils, then it becomes the core of a transformer.

26 X Q. You need not be so suspicious of my questions. Let me put it this way: Consider the sketch of Nipher X Q. 10, to represent the core of a shell-type transformer, the coils not being illustrated do not the holes e and e^1 represent what the patent in suit describes at page 1, line 42 of the specification as "two rectangular openings?"

A. The patent refers to two rectangular openings in the plates and represents the plates as being put in a pile of this kind around the copper coils. The form shown in the sketch is like that shown in the drawings of the patent in suit where there are two rectangular openings occupied by the copper coils except that in the
94 sketch referred to in the question, there are no spaces shown in the core. Complainant's counsel represents this to be the

core of a transformer having rectangular openings for the coils and it has that appearance.

27 X Q. Do you understand the word "opening" as used in the patent and as you have used it in your last answer to have the significance embodied in the following definition of that word which I quote from the Century Dictionary:

"An open or clear space affording approach, entrance or passage?"

A. I think definition three applies more directly. The passage in the specification recites that "The plates are preferably constructed with rectangular openings." This has reference to the individual plate which make up a well-known type of transformer core. Definition 3 of the Century Dictionary, is as follows:

3 "A breach or gap; a hole or perforation; an aperture; specifically in arch., an unfilled part in a wall left for the purpose of admitting light, air, etc."

This core is not the core of a transformer or converter until these rectangular holes are made through it. And it is put around the coils in a manner well known at the date of the patent in suit. In claim 4 the words "electric converter" taken in connection with what is elsewhere shown in the patent necessarily includes these holes through which the copper coils run. The word "opening" inquired about refers to openings in each plate so placed that when the plates are superposed they form the well-known channel which the copper wire are to occupy. When I say well known, I mean known prior to the date of the patent, as shown in the exhibits in this case. The patent itself identifies these openings as the openings in each
95 plate "e^1 and e^2 through which the wires pass" (p. 1, lines 41 to 43). This is the passage referred to in 13 X Q.

All that part of the answer which commences with the words, "this core is not the core" and thereafter is objected to as argumentative and volunteered.

Recess until 3:15 p. m.

At 2:15 p. m. this 14th day of August, 1903, parties met and further proceedings were had as follows:

Present—Same as last noted.

28 X Q. What term occurs to you as an apt one to define that portion of the space contained within the core as a whole or within the limiting area of the core as a whole which is occupied by the coils in a completed transformer, such, for example, that shown on page 7 of complainant's exhibit, Wagner Co. Catalogue, which I now hand you, or as is indicated by the dotted lines drawn from left to right of figure 2 of the patent in suit?

A. The space to which you refer, as I understand the question, is the space occupied by the coils and not the space occupied by the core. They do not occupy the same space. In a geometrical sense the part of the coil may be said to be within the core, and in the same sense a part of the core may be said to be within the coils.

They link with each other, but are separated from each other. I do not know of any term specially adapted to define the space occupied by the coil.

These spaces which the coils occupy can be referred to in various ways by descriptive phrases which will be understood by anybody.

96 A name does not define a thing. You can define the sense in which a word is to be used, but a familiarity with things or forms is obtained by inspection rather than by definition. Anything intelligible will pass as a name if it comes to be understood to those skilled in the art.

29 X Q. I think you did not express an understanding of the question, and it is possible that you have purposely avoided a meeting of the minds. The space to which I refer is not the total space occupied by the coils of a converter, but it is that portion of the transformer area which, in a shell type transformer, such as referred to in the last question, is formed by the openings punched in the core plates, when considered in toto—i. e., after the core plates and the coils have been assembled in the contemplated structure. It is not usual to call that the coil opening or coil openings, and is that not, to your knowledge, a generally accepted term among electricians?

A. Such a term as this would be intelligible, and it would be as proper to call these openings through the core of the transformer coil openings as any other descriptive term. The shell type of transformer necessarily has openings cut into the plate of the core through which the coils are passed. These openings give character to the core. It is not a core until they exist there. The core is, in fact, given such a form that it surrounds the coil in a certain sense, and the space so surrounded by the core might be called a coil opening. That phrase would certainly be intelligible.

30 X Q. You say that the space now under consideration "might" be called a "coil opening." Complainant's counsel expects to introduce evidence that this is the accepted term for it. If you have any other, I would like to have you give it and cite me to any authority you may have?

A. I see no objection to this term. The core is formed by cutting openings into iron plates, and these plates are put in a pile so that the copper coil occupies the openings thus formed.

31 X Q. Have you any objection to, or do you accept, the

97 term "ducts" or "oil ducts" used by the defendant in its bulletin, complainant's exhibit, defendant's catalogue, in the part which is descriptive of the cuts on page 7, in the sense in which those words are there used?

A. I know of no reason why I should object to these words in defendant's catalogue. Their meaning is very clear when taken in connection with the illustration referred to in connection with them.

32 X Q. Have you read the deposition of Dr. Samuel Sheldon, given on behalf of the complainant in this suit?

A. I have.

33 X Q. Is there any patent or publication which has been called to your attention in this case prior to the patent in suit which, when taken by itself shows: (3) the combination of an electric converter,

constructed with ducts in its core, said ducts being formed by interposing spacing strips between the coils or between the coils and the core, an enclosing case and a non-conducting fluid in said case adapted to circulate through said ducts and about the converter. I am using the word "duct" in the sense in which I understand it is used in defendant's catalogue, to wit, to denote the oil ducts illustrated on page 7 of Complainant's Exhibit, Wagner Co. Catalogue, and further identified by the upwardly pointing arrows on the lower figure of page 7.

A. This question assumes the very point to be decided by the Court in this case. The question is whether any prior device showed in combination, an electrical conductor having ducts in its core which the remaining portion of the question locates outside of the core. The position of the ducts referred to in the question with reference to the coils and the core is the same as the spacing strips referred to. These spacing strips are described in the question as being "Between the coil and the core." If they are between the coils and the core they are not in either of the things which they are between. The coils are not in the core. They are in chan-
98 nels which were cut out in order to form a core. The coils, the spacing strips and the ducts referred to in question are not in the core. If you wish an answer to this question with the absurdity involved in the words "In its core" eliminated I shall be pleased to answer it.

Judge Townsend said in his decision in the Union Carbide case:

"We have, then, in the prior art every element of the combination claimed and a physical combination of the same elements, except that the separations in Stanley are not adapted to and the construction of the enclosing case is prohibitive of the purposes of the claim in suit."

This decision refers to the claim now in suit at the time when complainant was seeking to restrain the defendant from the use of a converter having open spaces in the core. The Stanley Patent referred to is U. S. Patent 349,612, Stanley's Patent of the same date, No. 349,616, shows a converter having open spaces in the core adapted to circulate a cooling medium through them but it was not in an enclosing case. If that last-named Stanley transformer were placed in an oil tank, such as Millar used for cooling his transformer, it would then contain the elements recited in your question, so far as spaces in the core are concerned, and it would operate perfectly so far as cooling of the core can secure perfect operation. The ducts which are mentioned in the question are not in the core at all. This same patentee, Westinghouse, in his English Patent, describes such ducts as being between the coils and the core, and the drawings of that patent so show. My whole prior testimony has been to the effect that the coils are not in the core in the case in question. The English Patent to Westinghouse distinctly recites in claims 10 and 11 that the coils are separated from the surrounding core by these spacing strips. Certainly spaces between the coils are then also outside of the surrounding core.

99 Answer objected to as irresponsive and argumentative.

34 X Q. I would like to have you drop your line of reasoning and confine yourself to what you believe to be the ultimate facts inquired about. Inasmuch as you make some criticism upon my language which I desire to avoid, and because, as you say, the substance of my last question is the crux of the case, I will reform that question as follows: Do you know of any patent or publication, prior to the patent in suit, which, taken by itself, shows: (4) the combination of an electric converter constructed with ducts in its core, said ducts being formed by interposing spacing strips between the coils or between the coils and the internal surfaces of the coil opening, an enclosing case, and a non-conducting fluid in said case adapted to circulate through said spaces and about the converter. I will ask you, in considering this question, to regard the word "ducts" in the sense specified in my last question.

A. The reformation in this question does not seem to be very deep. This question differs from the other only in reciting that one set of ducts inquired about—to wit, those between the coils and the core—are here described as being between the coils and the internal surfaces of the coil opening, and all of these ducts are in the question located in the core. I object to this description. It is absurd. I will furthermore remark in answer to this question and the preceding one that the patent in suit does not show the combination of an electric converter constructed with ducts or openings of any kind, said ducts being formed by interposing spacing strips between the coils and the core, or between the coils and the internal surfaces of the coil openings, nor is anything of the kind remotely hinted at in the patent in suit, so far as I have been able to discover. The proposition of separating the coils from each other, as is shown in figure 1, by tubes of vulcanized fiber marked "ss_2 f^2," was a very much simpler proposition; at least, it was a different proposition from that involved in separating the coils from the core. The patentee may have known how to do this separating the coils
100 from the core, but he did not disclose his knowledge in this patent in suit. He did do it in his English Patent of the same date, and there claimed what he did not claim in his American Patent—to-wit, open spaces between the coils and the core formed by strips "separating the coils from the core." In the patent in suit spaces between the coils are shown unquestionably and they are referred to in claim 1 of the patent in suit which reads as follows:

"(1) The combination, substantially as described of a soft-iron core, and parallel primary and secondary coils having an open space intervening between them."

These spaces between the coils are not referred to in any other claim of the patent in suit. There are other converters in the prior art having ducts formed by spacing strips and by other means equivalent in character which separate both the primary and the secondary windings, and the iron core into sections for purposes of cooling. This construction was well known and has been referred to in my direct examination. I refer for instance to United States

Patent No. 266,290 of 1882, to Hindley & Buffham. None of the ducts inquired about are in the iron core and the ducts between the core and the coil are not referred to or in any way described or shown in the patent in suit. Open spaces between the core and the coil are shown in the prior art as I have described in the direct testimony. In Thomson's Patent No. 360,122, application for which was filed May 21, 1884, such an open space is shown between the iron core and the coil.

Answer objected to as wholly irresponsive and argumentative.

35 X Q. Now, it is perfectly clear from that sentence of your foregoing answer which commences, "I will furthermore remark" that you have clearly in mind the precise construction inquired
101 about and the specific combination which I have presented to you in view of the importance of the matter, I will ask you again whether you will not kindly state for the benefit of the Court, regardless entirely of what you may believe to be its pertinency or materiality, whether you can point to a single patent or publication prior to the patent in suit which, taken by itself, shows the precise structure described in my last question and discussed by you in the part of your last answer to which I have just alluded. And, in order that there may be no misunderstanding on this point, I will state frankly that I will consider any indirect or evasion of it as proof of your inability to point to the precise construction inquired about in the prior art.

A. I do find in the prior art a transformer having parallel primary and secondary coils with an open space intervening between them, such coils being separated into groups or sections adapted to the circulation of oil or any other cooling material through them. This transformer is also provided with an open space between the coils and the core which is also adapted to the circulation of oil or other cooling agent through this space between coils and core. All of this is shown in Thomson's Patent before referred to. This transformer was designed for the transmission of power on a commercial scale in a system of electric distribution. I refer particularly to figures 3 and 4, and also to figure 17, of United States Patent 360,122 to Thomson. This patent, therefore, shows what the patent in suit does not either show or claim, to wit, open spaces between both primary and secondary coils and the iron core, as well as spaces between the primary and secondary coils, and also a separation of both primary and secondary coils into sub-sections adapted to cooling purposes. If this Thomson converter were placed in the Millar oil tank it would contain everything inquired about in the question excepting that there are no such constructive details shown as spacing strips. I take it that these parts
102 would be held in position in some suitable way well known at the time of the application for this patent. There are other patents which show other features inquired about in the question. All of the things inquired about were well known in the prior art as the Courts have already found. I certainly understood the construction inquired about, but I did not wish to give

any countenance to the assumption in the question that ducts outside of the core are in the core. This patent to Thomson just referred to comes as near to that perhaps as any other to containing a combination of the elements inquired about.

Answer objected to as wholly irresponsive, excepting the last sentence.

36 X Q. Will you please state whether you know of any patent or publication prior to the patent in suit which shows (5) the combination substantially described, of an electric converter constructed with such an arrangement and separation of parts as would permit the circulation about them of oil, an enclosing case and a non-conducting fluid in said case adapted to circulate among such separate parts and about the converter? Understanding the phrase "Separation of parts" to mean openings formed by blocking apart groups of core plates or openings formed by blocking apart the coils imbedded in the core, or by interposing blocks or strips between the coils and the internal surfaces of the coil openings.

Adjourned to Saturday, August 15th, 1903, at 9:30 A. M.

103 Parties met pursuant to adjournment this 15th day of August, 1903, at the hour of 9:30 o'clock A. M., when the following proceedings were had:

Present: Same as last noted.

FRANCIS E. NIPHER, in continuation of his deposition, further deposes and says as follows:

A. to X Q. 36. All of the elements mentioned in the question were very old and well known in the prior art, and some of them are not revealed or shown in the patent in suit. The separation of a body to be cooled into sections with ventilating channels between was well known and came into the art of electric machinery very naturally from experience in the drying of lumber, where convection air currents are used for the purpose and have been used ever since timber has been dried. Such separation into parts in the case of an electrical converter is shown in the patent to Hindley & Buffham. It is shown in every figure of that patent. Every part of the converter is cooled by convection currents. The elements of the core are shown blocked apart in figures 1, 3, 4, and in figure 2 they are shown blocked apart, with the coils embedded in the core, *e* being the coils and *g* the core in that figure. The same things are shown in the patent to Fisher of 1882. Both of these converters are of the kind that can be cooled by air circulation, and they are so cooled to this day, even in the largest forms used. The Stanley converter shown in U. S. Patent No. 349,616 shows a similar blocking apart of core plates, but does not show separation of the coils from each other or from the iron core. The Thomson Patent No. 360,122 shows in figures 3, 4 and 17 converters constructed with the separation of parts inquired about. The primary and secondary coils are separated from each other and from the iron core by spaces adapted

to the circulation of oil through these spaces. If these Thomson converters should become overheated, and it were desired to
104 increase the capacity by cooling them down more completely than an air circulation would give, the Millar Patent of 1883 showed exactly how this could be done, by means of oil. In this Thomson Patent the form of the converter was well known many years before the date of the Thomson Patent. I have one such converter that has been in my laboratory for over thirty years. I do not know how much longer such transformers were in general use thirty years ago for instruction purposes. The core was always made of a bundle of iron wires, and the core always fit very loosely into the coil opening. In the one in my laboratory to which I have referred the cross-section of the core is about one-half the cross-section of the hole made for its reception in the wire coil. When competition between makers of transformers became keen it became necessary to get as much work as possible out of a given mass of material, copper and iron. This required artificial cooling, to be applied to the transformer. The transformer had already been made in a form which was adapted to this cooling, either by air or by oil. Millar had shown such an oil-cooled converter. It was as easy to put the best types of transformers into an oil tank for purposes of cooling as it was for Millar and Brooks to put in the earlier forms, which were not designed for heavy commercial work in lighting and power transmission. The Thomson Patent referred to comes, I think, nearest to answering all of the elements mentioned in the question. This is shown in the patents without an enclosing case filled with oil, but it is adapted to be thus cooled. In an air-cooled transformer the cooling is more effective without a case. The case is necessary in order to give protection to the copper coils. The case protects it from dust, from mechanical injury and perhaps from water. An air-cooled transformer with a case should be provided with openings or flues in the case to promote circulation of the air. In an oil-cooled converter the case must of necessity be closed if the oil is to be retained. This Thomson device does not show
105 any blocking apart of the iron wires forming the core. There are not, therefore, in this device any open spaces in the core such as are described in the patent in suit. It does contain open spaces between the coils and the core which the patent in suit does not show. It also shows, like many of the former devices, open spaces between the coils which the patent in suit also shows and attempts to cover in claim 1.

Counsel for complainant objects to all of the foregoing answer, except beginning with the sentence the "Thomson Patent referred to comes," and the sentence next succeeding that, as being wholly irresponsive and argumentative. The answer is further objected to because it is an endeavor to show the invalidity of the claim at issue, which issue has been adjudicated adversely to this defendant in the Union Carbide case.

37 X-Q. Do you understand that in the defendant's construction as illustrated in the "American Electrician" article, and on page 7 of the Complainant's Exhibit Wagner Co. Catalogue, the arrange-

ment and separation of parts is made for the purpose of securing the circulation of the oil about them and of radiating the heat generated in such parts by means of currents of convection in the oil to the enclosing case, there to be radiated to the surrounding air.

A. I certainly do so understand it. This is the purpose avowed in the catalogue of the defendant company.

Cross-examination closed.
Deposition of F. E. Nipher closed.

F. E. NIPHER.

106 Counsel for complainant states that he is now prepared to proceed with the cross-examination of the witness Wells and asks that he be produced for cross-examination in accordance with the stipulation entered into between the parties at the close of the session of August 8th, 1903, and counsel notes the fact that to-day (Saturday, August 15th, 1903) is the last day of the time limited by order of the Court for the taking of defendant's testimony, and also notes the fact that the said witness Wells was in St. Louis and at the office of the defendant's counsel on Wednesday, August 12th, 1903, and was seen at that time and place by complainant's solicitor, Mr. Byron F. Babbitt, and that the said Wells informed Mr. Babbitt at that interview that he had not at that time definitely arranged to leave the city.

Counsel for defendant, Mr. Bryson, replies that according to his recollection the foregoing is not a correct statement of what occurred at his office on last Wednesday. Mr. Bryson states the fact to be that when the said Wells visited his office on Wednesday afternoon he said that he had definitely arranged to leave St. Louis Thursday evening; that he had an engagement with persons in the southwest, in Oklahoma and Texas, which was final and could not be broken; that said persons were waiting for him at the time fixed and expected him to be there on business of a professional nature; that on said date (Wednesday, August 12th,) counsel for the defendant informed Mr. Babbitt, solicitor for complainant, of Mr. Wells' intention to leave the city and requested that Mr. Babbitt cross-examine said witness Wells before he left the city; that he offered to submit the said Wells for cross-examination at that time, then and there, or at any other time before he left the city, but that Mr. Babbitt de-

107 clined to cross-examine said witness.

Counsel for complainant states that he will not at this time discuss the correctness of the alleged facts, but even if they are as counsel for defendant states them to be, it shows that counsel for defendant have broken the engagement made with plaintiff's counsel to produce the witness for cross-examination on August 14th and 15th; nor could Mr. Babbitt have entered upon the cross-examination of the witness Wells at that time without violating that agreement; nor could the cross-examination have been made at the time suggested, because the day of that conversation, to wit, August 12th, 1903, was dies non as far as the taking of those depositions is concerned, an adjournment having been taken specifically, by agree-

ment of counsel, from August 11th to August 14th, as appears noted in the record at the close of the session of August 11th.

Counsel for complainant renews his request that the witness Wells be produced now for cross-examination, and in default of which he insists that counsel for defendant withdraw the deposition of the said Wells from the case.

Counsel for defendant makes no reply.

Continuation of Deposition of W. A. Layman.

NOTE—The preceding portion of this deposition will be found at page 76.

W. A. LAYMAN, having been produced for cross-examination, in answer to the questions propounded to him by Mr. D. W. Cooper, counsel for the complainant, testifies as follows:

108 X Q. 30. Were you ever actually employed in the transformer department of the defendant company's works, and, if so, when?

A. For about six years, from 1892 to 1898, I was actively employed in transformer work for the Wagner Company.

As early as 1892 and 1893 I made all of the transformer drawings for the company. During a considerable portion of that time I tested all of the transformers for the company, and in various ways up to 1898 participated in the supervision of construction and testing of transformers built by that company and also in the installation of such transformers built by the Wagner Company.

X Q. 31. Your present duties are those of a general supervision of the entire business of the Wagner Company?

A. Yes, sir.

X Q. 32. How long have your duties been of that character?

A. Since August, 1902.

X Q. 33. What were your duties with relation to the defendant company prior to August 1st, 1902?

A. I was assistant manager and treasurer.

X Q. 34. Your duties as assistant manager and treasurer covered what period?

A. From about February or March, 1898, as I recall it at this moment.

X Q. 35. During the time that you acted as assistant manager and treasurer your duties were of a supervisory character over the business of the whole company, were they not?

A. They were not.

X Q. 36. What were your specific duties?

A. My duties at that time pertained mainly to the commercial side of the business. I had nothing to do with the manufacture and operation of the transformer department except to be consulted by our superintendent when I could make any suggestions or advise him regarding those matters.

X Q. 37. So you were not actively engaged in trans-
109 former building during that period?

A. No, sir; I was not.

X Q. 38. And you have not been actively engaged in the supervision of the transformer building since the early part of 1898?

A. That is correct.

X Q. 39. Who, in the employ of the company, would have more specific knowledge of what was done in the transformer department than you during that period?

A. The business of the transformer department was entirely under the supervision of Mr. Fred Schwedtman.

X Q. 40. Is he still living here in the city?

A. Yes, sir.

X Q. 41. He is at present engaged in business with the Mr. Wells, who has been called as a witness in this case, is he not?

A. Yes, sir.

X Q. 42. As far as you know, Mr. Schwedtman is at this time in St. Louis?

A. I have no knowledge of his movements, but I believe he was in St. Louis the early part of the week?

X Q. 43. He may be now, for all you know?

A. I think so. I was indirectly informed that he was out of town yesterday.

X Q. 44. Did you see him on the day you testified in this case, to-wit, August 11th, 1903?

A. I think I saw him Wednesday, but not Tuesday. I testified Tuesday.

X Q. 45. How long has the defendant company been manufacturing transformers like that illustrated on page 7 of complainant's exhibit, Wagner Co. catalogue?

A. I think since about June, 1900; although this construction does not differ materially from the construction theretofore.

X Q. 46. From your familiarity with the proceedings in the Union Carbide case, and by refreshing your recollection by reference to the record which I now hand you, you recall, do you not, that that suit was brought on the patent here in suit about May, 1900.

A. Having looked at the record which you have just
110 handed me it appears that the bill of complaint in that case was filed in May, 1900.

X Q. 47. You have referred to a construction which in your judgment is not materially different from that illustrated in the catalogue shown you, which you say was manufactured prior to the time when you commenced the manufacture of the transformer here inquired about. Was that earlier one to which you refer of the construction illustrated on page 45 of defendant's exhibit 23?

A. It was substantially as shown in figure 41, to which you refer. The copper coils are grouped differently though.

X Q. 48. What does the thick black line on the cut on page 45 of exhibit 23, which for convenience of reference I will mark with the letter "X," represent?

A. That is a corner piece of insulating material, which serves to assist the insulation of the coil and keep it from grounding against the core.

X Q. 49. Was that corner piece of insulating material to which you refer "U" shaped so as to embrace one of the longitudinal edges on the side of the group of coils?

A. The shape of this strip of insulation is that of an ordinary channel.

X Q. 50. A cross section of this strip would be of what shape?

A. A cross section of that strip would be a right angle.

X Q. 51. There appears to be another small strip at the opposite longitudinal edge of the coil, is that correct?

A. That is correct.

X Q. 52. In the transformer, like that illustrated on page 41 of the catalogue, Defendant's Exhibit 23 were there spacing strips such as enter into the construction shown on figure 7 of Complainant's Exhibit, Wagner Co. Catalogue?

A. That would depend upon the size of the transformer as to whether there were spacing strips or not. We did not use
111 them in the small transformers but they were used in the large transformers to enable the oil to flow freely between the coils and the core and between the individual coils.

X Q. 53. Are you the W. A. Layman who testified on behalf of the defendant in the suit brought on this same patent by this complainant against the American Transformer Company?

A. Yes, sir.

X Q. 54. You testified with reference to transformers of the construction illustrated on page 7 of Complainant's Exhibit, Wagner Co. catalogue in answer to a question, being cross-question 85?

"85 X Q. How long had you been making these M's?

A. About a year and a half prior to December 1st, 1902.

86 X Q. The horizontal and vertical sections on page 7 correctly represent the interior construction of both types?

A. Substantially so.

87 X Q. How long have you used just that construction in your type M transformer prior to December 1, 1902?

A. Since the bringing out of the type M, about a year and a half before."

Q. Did you testify as I have read in that case?

Objected to as calling for secondary evidence, no foundation having been laid for its introduction, the record itself or a certified copy being the best evidence.

A. Assuming the record to be correct, to the best of my recollection the testimony as you read it is correct.

X Q. 55. Is that the same construction to which you referred a little while ago when you said that the Wagner Co. first began its manufacture about June, 1900?

A. I assume your question refers to the construction
112 shown in figure 341?

X Q. 56. Yes on page 7 of Complainant's Exhibit Wagner Co. catalogue?

A. The construction of figure 341 is the construction referred to in the testimony which you have just read.

X Q. 57. Were you not mistaken then in testifying in your earlier cross-examination, in the present case that you adopted that construction in June, 1900. What I refer to is this; you said a month ago that you adopted that construction in June, 1900, whereas in your testimony which I have just quoted it would appear that you adopted it in June, 1901?

A. Putting the two together there appears to be a discrepancy of a year in the two records. Regarding that discrepancy I would say that I have in each instance testified without refreshing my recollection as to exact dates. This last testimony being based on bulletin 43 my best recollection at this moment is that we were building type "M" transformers about 6 months before bulletin 43 was issued. I can easily get the exact dates by telephoning to the factory if you so desire.

X Q. 58. Bulletin No. 43 is Defendant's Exhibit 3, is it not?

A. Yes, sir.

X Q. 59. Now was not a copy of that bulletin before you when you testified in the case of this same complainant against the American Transformer Company?

A. The bulletin to which you refer was produced at the conclusion of that testimony. My present recollection is that my testimony was practically closed when bulletin 43 was shown to counsel for complainant.

X Q. 60. Is it not true that all of the testimony you have given regarding the dates when your company began the manufacture of the several types of transformers inquired about, has been given from your general recollection and without you having
113 specially refreshed your recollection as to exact dates?

A. Yes, based on my recollection growing out of intimate contact with the business. I will say that in no case can the dates as given by me be very far from the exact dates.

X Q. 61. They may be a year or more out of the way as was the case with type "M?"

A. I should say within four or five months. The substantial fact running throughout the testimony has regard to the spaces between the coils and between the coils and the iron, and transformers constructed with those spaces were made by the Wagner Company practically from its earliest construction of oil-filled transformers. The various types of oil-filled transformers built by the company differ as to details but they are all on the same principle as regards the employing of spaces between the coils and between the coils and the core.

X Q. 62. From your personal knowledge, or rather have you personal knowledge whether the design of defendant's transformers was adopted or created by the person actually designing them, with full information as to what other companies, notably the Westinghouse Electric Manufacturing Company, had done in that line?

A. I think the designing engineers of the company were fully posted as to the practice of other companies.

X Q. 63. The Mr. Wagner from whom the defendant company takes its name was a former employee of the Westinghouse Company, was he not?

A. I think so.

X Q. 64. And others in your employ came from the Westinghouse Company, did they not?

A. I am not prepared to make a statement about the workmen throughout the factory, but I happen to know it to be the fact that Mr. Wagner was at one time in the employ of the Westinghouse Company.

X Q. 65. Were you in a position to know whether in the year 1897 or prior to that time the Wagner Company manufac-
174 tured and sold transformers the core-plates of which were blocked apart into groups by blocks or spacing strips?

A. Yes, sir.

X Q. 66. Did they manufacture such transformers prior to that time?

A. Yes, sir.

X Q. 67. And put transformers of that construction into oil-filled cases?

A. Yes, but the company first began the manufacture of transformers for use without oil. The construction was not modified to use oil, but was practically the same as for operation dry. The dry transformer simply being placed in a case filled with oil, it being entirely obvious that a dry transformer would run cooler when immersed in a case of oil.

X Q. 68. That was subsequent to 1887 that you are speaking of?

A. Yes, sir.

X Q. 69. How long subsequent to that time?

A. That must have been about 1893 or 1894.

X Q. 70. Were you in a position to know that in the year 1896 or 1897 the Westinghouse Electric Manufacturing Company gave to the Wagner Company, the defendant in this case, notice of infringement by the Wagner Company, of the patent here in suit.

A. I knew nothing of it at that time, but my recollection of my late knowledge of the matter has been refreshed by counsel during the past few days.

X Q. 71. You recall when such notice was given?

A. At the time that notice was given I had nothing to do with the patent matters of the company, but I will state that I am advised that it was somewhere in the year 1897.

X Q. 72. You admit that the defendant company had notice of the patent in suit as early as the year 1897?

A. Basing my knowledge of that fact on a conversation I had a few days ago with counsel for defendant I will say that I now know that such a notice was given covering this patent as well as several other patents.

X Q. 73. You were so advised by counsel?

115 A. Yes, sir. Counsel so advised me, and I remember a report made to the company by counsel on this patent.

X Q. 74. At that time Mr. Wagner was connected with the company, was he not?

A. Yes, sir.

X Q. 75. He has since left the company?

A. Yes, sir. He has left the company as far as being actively identified with it is concerned, but he is still a stockholder in the company.

X Q. 76. Are you informed whether the Union Carbide Company, about which you have testified, is a user of apparatus manufactured by the Westinghouse Electric Manufacturing Company, the complainant herein?

A. I have never seen such apparatus, but I have been told they were using some Westinghouse transformers.

X Q. 77. You have testified to your knowledge of the Wagner Company's transformers that are now and were heretofore used by the Union Carbide Company, said transformers being the basis of the suit on this patent between the Westinghouse Company and the Union Carbide Company, I now show you an article from the "American Electrician," and will ask you if the Wagner Transformer described in that article, said description being stipulated in the Union Carbide case, to be a correct description of the Wagner transformer there in issue, shows or can you point out to me on the illustration of that article as it appears on page 217 of the Carbide record, the spacing strips, which you say intervene between the coils and between the coils and the core?

A. No such strips are visible in the illustration you refer to.

X Q. 78. Is there any description of such spacing strips in the text?

A. I do not know.

X Q. 79. Please examine the text and then satisfy yourself,
116 and then answer the question?

A. I would not like to answer that question without reading the entire article. I will say regarding that article, that it was prepared by the "American Electrician" and was not prepared by the Wagner Company.

X Q. 80. I want to get your evidence as to whether from an examination of the article referred to, including the text and the illustrations, you can determine, from that information alone, whether there were any spacing strips intervening between the coils and between the coils and the inner surface of the core in that construction. I will ask an adjournment in order that you may read the article in order to satisfy yourself on that point before answering the question?

A. I can read the article during the noon recess if you so desire.

Mr. Cooper, counsel for complainant, states that he does not wish to go ahead with the examination until the witness has had a chance to read the article and answer the question, and, therefore, suggests that as it is now after 12 o'clock a recess be taken until 2:30 this afternoon which will afford the witness an opportunity to read the article in question.

At this stage of the examination an adjournment was taken until 2:30 this afternoon.

At 2:30 P. M. further proceedings were had as follows:

117 Present—Same as last noted.

W. A. LAYMAN, in continuation of his deposition, further testifies as follows:

A. During the recess hour I have examined the article in question which is reproduced in the record of the Union Carbide case, and while I have not read every word in the article I have carefully read that portion of the description referring to the Wagner Company's 2,000 horse-power transformers as it appears in that article, being page 216 of the record. I find no reference in that portion of the article to spacing strips between the coils and the core in the Wagner transformer.

I wish to add, however, that this article is one covering twenty pages, each page of which is divided into three columns and covers the description of a variety of apparatus at Niagara Falls. The description of the Wagner Company's transformers occupies about one and one-third pages out of the twenty, including the illustrations thereof. I also find at the bottom of the first column of page 217 of the record the following words in the descriptive text: "A few of the details of construction of these transformers are of interest." I would like to emphasize the word "few" as it appears in the article, because the article itself discloses the incompleteness of this description of the apparatus. The article then proceeds to describe a few of the exterior features of the transformer proper and does not refer in any way to the internal construction of the apparatus. I also find that there is no cross-section view of the transformers, which view would be necessary to disclose spacing strips between the coils and between the coils and the core. I will state further that on examination I believe there is throughout the record of that

118 case no illustration showing a cross-section of those transformers. I will say further that the spaces between the coils and between the coils and the core were not emphasized nor, to my best recollection, referred to in the record of that case, nor were they pertinent to the issues of that case. My inference has always been that the introduction of this particular article from the "American Electrician," in the preparation of which the Wagner Company, as stated above, had no part (the introduction of which was by stipulation, I believe), was for the purpose of disclosing the elements of construction infringing claim 4 of the patent in suit. I have always been under the impression that figure 24 of page 217 of the record fully disclosed the features of construction on which the complainant based its case in the suit against the Union Carbide Company.

All of that part of the answer which undertakes to set forth the inferences and belief of the witness is objected to as incompetent and immaterial.

X Q. 81. Has the Wagner Company recently undertaken to fill

an order for three or more large oil-cooled transformers, to be installed in the power house of a plant in California?

This line of testimony is objected to because it does not appear whether or not those transformers, if ordered at all, were ordered before the filing of the bill in this case, and therefore, any testimony touching them is incompetent, immaterial and irrelevant.

A. We are constantly supplying transformers throughout the country, and it would be necessary to give me a better description of the apparatus before I could say whether we have taken such an order as Mr. Cooper has in mind.

X Q. 82. I will say that my information is that it was an
119 order for three or more oil-cooled transformers of 500 kilowatt capacity, probably of a larger number than I have stated and may be the size is different, but I think it is for 500 kilowatt or more and was for a power house in California?

The same objection as last noted.

A. Are they high tension or low tension transformers?

X Q. 83. I have no definite information on that point?

A. I am not aware that any such order has recently been taken by the Wagner Company.

X Q. 84. Has that company recently taken an order for oil-cooled transformers of five-hundred kilowatt capacity or more to be sent to California?

Same objection as last noted.

A. I do not recall any such order.

X Q. 85. Would you have known of it if there had been such an order?

Same objection.

A. I think I would.

X Q. 86. Have you taken any orders for transformers to be used at Redlands, California?

Same objection.

A. Not within the last few years. My recollection is the last transformers which the Wagner Company supplied to be used at Redlands, California, was in 1896.

X Q. 87. Have you any orders for transformers yet to be supplied there?

Same objection.

Counsel for defendant protests against this impertinent in-
120 quiry into defendant's business without some showing is made as to the relevancy of this testimony.

A. None that I know of.

X Q. 88. Or anywhere else in California of approximately the size that I have indicated?

Same objection.

A. None that I know of.

X Q. 89. Are you bidding for such an order? By you I mean the Wagner Company, the defendant in this suit.

Same objection.

A. Not that I know of.

X Q. 90. Would you likely know it if the company were bidding for such an order?

Same objection.

A. Not necessarily, but the chances are that I would be informed about it.

X Q. 91. Have you any knowledge whatever of the facts inquired about?

A. No, sir.

(The WITNESS:) I think counsel has in mind some transformers which, according to rumor, have been recently sold by the Moloney Electric Company of St. Louis for installation on the Pacific Coast.

Cross-examination closed.

Redirect examination by Mr. BRYSON:

Re-D. Q. 92. During the time you have been connected with the Wagner Electric Company, have you been familiar with the policy with respect to the infringements of patents; and, if so, please state what its policy has been in that respect?

121 Objected to as immaterial and as calling for the conclusion of the witness. Let him state the facts.

A. I am familiar with the policy of the company, and am the executive officer in carrying out the policy of the company in matters of that sort. It is the uniform policy of the company to respect valid patents, and in respecting valid patents we not only use our best judgment as to the validity or invalidity of an invention as set forth in United States Letters Patent, but we also secure legal advice where there is any question as to the infringement of a patent.

Re-direct examination closed.

Recross-examination by Mr. COOPER:

Re-X Q. 93. I recall at the present moment two instances in which your company has been held to have infringed patents, and it has been decided by the Courts that the patents that they infringed were invalid. I refer to the patent here in suit and to the Moody Patent No. 591,896, for an air-cooled transformer. Are there any other suits which you can now recall in which the Wagner Company has been held to have infringed valid patents?

A. Infringements that may have occurred in conducting the business of the Wagner Company are not necessarily the result of an intention to infringe valid patents. The two adverse decisions to which counsel for complainant refers are instances where we did not

regard the claims as valid. There is such a multiplicity of detail patents that, if they were to be conceded as valid on the mere face of the patent, infringements by perfectly legitimate manufacture throughout the country would be widespread. That is to say, we are guided by the best advice as to whether or not a patent is a valid patent, and take every means to inform ourselves regarding its
122 validity. I don't think any manufacturer in the country accepts a patent as being valid on its face.

In one of the cases referred to by counsel the litigation has not reached its final stage. The decision of the lower Court, it is true, is adverse, but that decision may be reversed in the Court of Appeals. I will say that those decisions, however, have been absolutely respected by the Wagner Company and in respecting them we not only comply with the requirements of the Court, but we actually carry out the policy we would have pursued had our original judgment been that the claims were valid.

This answer is objected to as irresponsive and as voluntary and argumentative.

Re-X Q. 94. I will ask that the question be read to you and request that you give me a more direct answer to it?

"Re-X Q. 93. I recall at the present moment two instances in which your company has been held to have infringed patents and it has been decided by the Courts that the patents that they infringed were valid. I refer to the patent here in suit and to the Moody patent 591,869 for an air cooled transformer. Are there any other suits which you can now recall in which the Wagner Company has been held to have infringed valid patents?"

A. There is a part of that question which, upon hearing it repeated, I find I have not answered. I have not answered your inquiry as to other suits. Answering that I will say I know of no other suits at this moment where the opinion of the Court has been adverse to the judgment of the Wagner Company prior to the handing down of such decision. There are several other suits in which the complainant in this case has been engaged in litigation with the Wagner Company but those suits have been decided
123 favorably to the Wagner Company or have been abandoned by the complainant. The only one that has been decided against the Wagner Company or rather in which the Wagner Company was interested is the Union Carbide case and the suit on the Moody Patent.

Re-X Q. 95. The only one that has been decided in favor of the Wagner Company was one against the Union Carbide Company on the Thomson Patent for water cooling and oil filled transformers?

A. I recall the one to which you refer and also another on a single-phase electric motor. I think that is a Thomson Patent also. The last case was brought by the Thomson-Houston Company upon a patent to Elihu H. Thomson.

Re-X Q. 96. I think so but I cannot now recall the exact title of the case. I understand the litigation is in the Circuit Court of Appeals for the second circuit.

A. Yes, that is the case to which I refer and the one to which you

refer as being favorable to the complainant and which is also in the Court of Appeals is a suit on an air blast transformer.

Re-X Q. 97. There is still another suit which is being actively prosecuted against your company on a patent to Elihu Thomson for a system of electric distribution?

A. I think so.

Re-X Q. 98. You have stated with some emphasis that great care has been taken by the Wagner Company in respecting the decisions of the Courts in cases that have been decided against it, and you laid considerable stress on your implicit obedience to those decisions. Let me refer you back to the suit on the Moody Patent 591,867 for an air-cooled transformer. What has your company done with respect to manufacturing and selling air-cooled transformers, or bidding on the same since that suit was divided?

A. We have followed the instruction of counsel regarding that decision and have avoided the use of those features of construction adverse to us in the decision of the Court.

124 Re-X Q. 99. Have you built air-blast transformers since that case has been decided?

A. I think not.

Re-X Q. 100. Are you prepared to build them in such a way as not to violate the decision of the Court?

A. You mean by that, in such a way that we believe it does not violate the decision of the Court?

Re-X Q. 101. Yes, or in such a way that your counsel does not believe violate the decision of the Court, or are you prepared to construct them substantially as set forth in the patent issued to Johanessen for an air-cooled transformer, the patent for which was issued about November, last year.

A. The patent to Johanessen to which you refer is one that covers certain details of construction. I do not recall at this moment just what those features are.

Re-X Q. 102. Do you object to giving me a statement of the features of construction you have adopted to avoid the Moody Patent to which I have referred?

A. I do not believe those questions are relevant and would prefer not to answer them unless instructed to do so by the Court.

I think those are matters connected with our business that should not be brought out unless they actually concern this case.

Re-X Q. 103. I am very sorry to disrespect your preference but you have purposely made the statement that the Wagner Company has respected fully the decisions of the Courts and you have gone into the matter in details doubtless with the intention of benefitting the defendant in the eyes of the Court. Under those circumstances I am entitled to all the facts on which you base that statement unless your counsel withdraws all those statements. Unless all those statements are withdrawn I shall insist on an answer to my question?

A. I do not think it is pertinent to the issues of this case to disclose the policy of the Wagner Company with respect to future matters. I do not regard it as essential in this case to state

125 what we might determine to do at some future time in the way of building transformers.

Re-X Q. 104. Are you building any air blast transformers?

A. As far as I know we have none under construction.

Re-X Q. 105. Have you any prospects in that line?

A. We have none under construction and I am not aware of any in prospect. I will say to you, in that connection, that the demand for transformers of that kind is comparatively small.

Re-X Q. 106. Have you any manufactured but not sold?

A. No, the company does not advocate the use of such transformers.

Deposition of W. A. Layman closed.

W. A. LAYMAN.

Subscribed and sworn to before me this 18th day of August, 1903.

JAMES R. GRAY,
Standing Examiner.

Counsel for complainant states that he is prepared to proceed with the cross-examination of the witness Wells.

Counsel for the defendant states that he can procure the attendance of Mr. Wells here at this office, on Tuesday morning, August 18th, 1903, at which time and place counsel for complainant can attend for purposes of cross-examining him; that he understands that counsel for complainants will be in Indianapolis, Indiana, on Monday, August 17th, and requests that he return to St. Louis on Tuesday morning for the purposes of cross-examining Mr. Wells; that he is anxious and willing to afford counsel for complainant every opportunity for cross-examining this witness.

126 Counsel for complainant replies that no evidence has been submitted to him, that the said Wells is not available for cross-examination to-day, and with all deference to the opposing counsel he cannot accept his word in lieu of such proof. Complainant's counsel further states that he has attended at this time under an agreement heretofore entered into, as appears on the records in this case, and that his power and authority to cross-examine defendant's witness terminates at the close of this day, under the rules of the Court; and further than that it will be impossible for him to return to St. Louis on Tuesday in view of other business engagements of an important nature; that finally if there were no other consideration which would prevent his attending at the time suggested, complainant's counsel would deem it sufficient excuse for his not returning at that time on the ground that it would be unreasonable to request his return at that time, because he has already journeyed twice to St. Louis from New York, to examine the witnesses of defendant, and no reason appears here of record which would justify or require him to attend again.

Complainant's counsel states that, in view of the fact that the witness Wells is not here for cross-examination he will decline to attend further, and requests that the Commissioner declare the session to be closed.

Stipulation.—Counsel for the respective parties agree that the exhibits offered may remain in the custody of the counsel offering the

same, to be filed at the final hearing of the case, or prior thereto if counsel offering the same deem it advisable so to do, said exhibits, however, to be produced for the inspection of opposing counsel at all times upon reasonable notice.

127 UNITED STATES OF AMERICA,
Eastern Division of the
Eastern Judicial District of Missouri:

I, James R. Gray, Standing Examiner of the United States Circuit Court for the Eastern Division of the Eastern Judicial District of Missouri, do hereby certify that the foregoing depositions of Francis E. Nipher, George E. Wells and W. A. Layman were taken before me at the time and place as therein appears, pursuant to notice hereto annexed, that the complainant in said cause was present at the taking of said depositions by his counsel, Mr. D. W. Cooper and Mr. B. F. Babbitt, and the defendant by its counsel, Mr. A. C. Fowler and Mr. James H. Bryson, as therein appears, that before the depositions of said witnesses were taken said witnesses were by me duly sworn to testify the truth, the whole truth and nothing but the truth in a certain cause now pending in the United States Circuit Court for the Eastern Division of the Eastern Judicial District of Missouri, wherein the Westinghouse Electric Manufacturing Company is complainant and the Wagner Electric Manufacturing Company is defendant, on the part of the defendant; that said depositions were reduced to writing from the statements of said witnesses and when completed were read over by said witnesses, respectively, and were subscribed and sworn to by said witnesses respectively, as hereinbefore noted.

I hereby certify that I am not attorney for nor of counsel for any of the parties in said deposition- and caption named, nor anywise interested in the event of this suit.

In testimony whereof I have hereunto set my hand this 18th day of August, 1903.

JAMES R. GRAY,
Standing Examiner.

128 United States Circuit Court, Western District of Missouri, Eastern Division.

In Equity.

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, Complainant,
vs.
WAGNER ELECTRIC MANUFACTURING COMPANY, Defendant.

Complainant's Rebuttal Testimony.

Evidence in Rebuttal on Behalf of Complainant, for Final Hearing, *de bene esse*, before Benjamin Barker, Standing Examiner of the United States Circuit Court for the Southern District of New York, commencing, pursuant to annexed notice, at the offices of Kerr, Page & Cooper, No. 149 Broadway, New York City, on the 22d day of September, 1903, at 11 o'clock in the forenoon.

Present—Drury W. Cooper, Esq., counsel for complainant, and A. C. Fowler, Esq., counsel for defendant.

Deposition of C. R. Cross.

CHARLES R. CROSS, a witness produced on behalf of complainant, having been duly sworn, deposes as follows in answer to interrogatories by Mr. Cooper:

1 Q. Please state your name, age, residence and occupa-
129 tion.

A. Charles Cross; age 55; residence, Brookline, Mass.; occupation, I am Thayer professor of Physics and Director of the Rogers Laboratory in the Massachusetts Institute of Technology, Boston, Mass.

2 Q. Please state what qualifications you possess to testify as an expert in patent causes, and particularly in a case involving electrical apparatus.

A. During the past thirty years I have had occasion constantly to discuss with my classes the various branches of theoretical and applied electricity, almost all of the important practical applications of electricity having come into existence since I began my teaching, so that I have grown up with the art. In 1882, at my suggestion, the corporation of the Institute established a course in electrical engineering, the first course of this kind to be opened in this country, and one of the first three or four in the world. I took charge of this course for twenty years, until within the past year, when the excessive increase in my work made it necessary for me to restrict my labors to the more purely physical as distinguished from engineering problems of electricity. In this connection I have had occasion to familiarize myself with dynamo electric machinery of all classes, including direct and alternating current machines,

transformers and the electrical transmission and distribution of power. I have made various researches in electricity, and have published papers thereon in the proceedings of scientific societies. I presided as chairman of one of the three sections of the International Electrical Congress, held at the World's Fair in Chicago, in 1893. I have had frequent occasion during the past twenty-four years to consider patents for inventions in electricity, and have often given testimony in the courts of the United States in suits in which the subject-matter involved the consideration of such patents, and the apparatus described in them.

3 Q. Have you read the patent in suit, and do you understand the same? If so, please state your understanding of the invention covered by the fourth claim of the patent.

130 A. I have read the patent in suit and believe that I understand it.

The patent shows an electrical converter, as it is termed by the patentee, in accordance with the nomenclature of the time, or transformer, as such an apparatus is now designated. In this form of transformer a particular and novel arrangement of the coils and cores is employed in order to obviate the difficulties which otherwise are experienced in the use of large transformers, in consequence of the overheating of the coils and cores. The coils and core are constructed or arranged with suitable spaces in and about them, and they are surrounded by a non-conducting liquid or gas which has ready access to the coils and the interior of the core. The whole apparatus is enclosed in a case.

The novel arrangement of parts under consideration is such as to allow a ready access of the insulating fluid to the interior of the core and coils, and at the same time permits the fluid, when warmed by the contact with the heated core and coil, to circulate freely, so that convection currents may be formed readily therein.

The convection currents thus set up carry the hotter portions of the fluid to the enclosing case, which is necessarily at a comparatively low temperature. This case has a large radiating surface, and hence allows a speedy dissipation of heat by radiation, and the formation of convection currents in the surrounding air. Hence, by this continuous circulation of the contained fluid the heat necessarily generated in the coils and cores of the transformer is carried away from these to the surrounding case and dissipated, as explained, into external space, so that the temperature of the coils and core is kept from rising to an undue extent.

Experience has shown that oil is the best fluid for the purpose under consideration, on account, among other reasons, of its high insulating power and the ease with which convection currents are formed in it.

131 Furthermore, as stated in the specification, the oil excludes moisture from the interior of the case, the introduction of which had been a serious difficulty in the operation of transformers.

The specification of the patent under consideration sets forth the use of intervening spaces wihch separate from one another the different working portions of the apparatus in which heat is gen-

erated, by the separation of different portions of the core from one another, or the separation of the primary and secondary soils from each other.

The patentee describes the construction of the core of one form of transformer, what has come to be known as a "shell-transformer," which core is built up of thin plates of soft iron, so that it contains two rectangular openings through which the wires of the primary and secondary coils pass. In a construction specifically described in the patent each group of five or six of the thin plates constituting the core is separated from the succeeding group by air spaces, which may be produced either by placing tubes between the groups or by the use of spacing blocks. There is also set forth a similiar separation by the same method of the primary and secondary coils from each other. Either or both of these arrangements of parts may be used. The language of the patent regarding the first mentioned structure is:

"Each group of—say five or six—plates thus applied is preferably separated from the succeeding group by air spaces."

Regarding the second structure which he mentions the patentee says:

"Preferably also the primary and secondary coils C^1 C^2 are separated from each other in a similar manner."

I understand these particular structures to illustrate methods of employing the invention described in the patent in suit;
132 but I do not understand that the patentee intended to limit himself to any particular form of spacing or separating or opening different portions of the core and the coils. There is certainly no such limitation in the invention itself as described in the specification.

The patent under consideration describes for the first time a transformer, in which by the use of oil or an equivalent fluid, the coils and core of a transformer in operation are kept cool by the formation of convection currents, and the transference of heat to the large radiating surface of a containing case, thus operating to prevent a damaging over-heating of the coils and cores.

The fourth claim sets forth the invention in question in the following language:

"4. The combination, substantially as described, of an electric converter constructed with open spaces in its core, an inclosing case, and a non-conducting fluid or gas in said case adapted to circulate through said spaces and about the converter."

According to my understanding of the patent the combination set forth in the fourth claim comprehends broadly structures of the class which I have just considered, whether the core is separated into different portions as specifically described, or the primary and secondary coils separated from each other, as specifically described, or both of these devices used simultaneously, or other obvious modifications of these employed, provided that such open spaces as those set forth exist so as to constitute ducts for the conveyance of the circulating fluid, and to allow the effective formation of convection currents.

4 Q. Do you understand the construction of the defendant's apparatus as exemplified in "Complainant's Exhibit Wagner Model," and as illustrated on page 7 of "Complainant's Exhibit Wagner Catalogue" and described in the accompanying text; if so
133 please compare said construction with the fourth claim of the patent in suit, giving your opinion as to the identity or lack of identity between the two, and state the reasons for such opinion as you may express.

A. I do understand the construction of defendant's apparatus referred to in the question.

The exhibit shows that the Wagner transformer is an apparatus of the character set forth in the Westinghouse Patent in suit. The core is of substantially the same character and construction as that set forth in the patent. There are, however, two sets of coils which are placed parallel with one another instead of a single set, as in the particular transformer specifically described and figured in the Westinghouse Patent. In each of these sets of coils in the Wagner transformer the low potential coil is placed between two high potential coils. There is left between the two sets of coils a free open space which is filled with oil, as set forth in the Westinghouse Patent in suit. Likewise the sets of coils are each set off and separated from the core so that the interior surface of the core is in direct contact with the oil. This construction provides vertical channels for ducts within the core, which allow of a free flow of convection currents in the oil. The apparatus is contained within an enclosing case so that the heat generated in the coils and core is carried by the flow of oil to this case, and thence dissipated into surrounding space.

The structure which I have described, so far as the electrically working portions are concerned, is obviously exemplified in the Wagner model referred to in the question. The Wagner catalogue describes minutely the construction and mode of operation of the apparatus.

The diagrams on page 7 show horizontal and vertical sections of a transformer of the class under consideration. They indicate not merely the construction and arrangement of parts, but also the paths of the convection currents, which are set up in the circulating medium. The text of the exhibit describes both the construc-
134 tion and the mode of operation of the device under consideration. It says regarding this:

"The cross section of a 15 K W transformer on page 7 illustrates very clearly the excellent provision that has been made for cooling primary and secondary coils, and iron, and keeping up a natural circulation of oil. This is one of the most important advantages of the shell type transformer. These oil ducts are so proportioned and so placed that, while they keep all parts of the transformer cool, and thus prevent deterioration of insulation and reduce ageing of iron to a minimum, they cause a minimum loss in efficiency."

I find in defendant's apparatus as exemplified in the exhibits referred to in the question everything substantial which characterizes the invention set forth in the Westinghouse patent in suit.

The cores and coils of the apparatus are placed in a tight enclos-

ing case which is filled with oil, spaces are left in the interior of the core between the coils and the core, and between the adjacent sets of coils in such manner as to allow of a free access of oil to the coil and to the interior core, and these spaces form channels or ducts such as to allow a free flow of oil to take place from the interior of the core to the outer enclosing case. In this way the end contemplated by the patent in suit is secured and moreover secured in the way which that patent discloses, viz., by separating the different working parts of the apparatus from one another in such manner as to leave channels through which a cooling flow of oil will be produced.

Furthermore, in my judgment, the Wagner apparatus, as shown in the exhibits, embodies the specific invention set forth in claim 4 of the Westinghouse Patent in suit.

It is an electrical converter or transformer, which is constructed with open spaces in its core, that is, the spaces which lie between the iron of the core and the coils and between the sets of
135 coils, which open spaces are such as to allow the setting up and continuance of convection currents in the non-conducting fluid, oil, which surrounds them and fills the enclosing space in which the coils are placed, and which being adapted to circulate through those spaces and about the converter, acts to keep the temperature of the core and coils from rising to a harmful amount.

Moreover, it seems to me that the Wagner apparatus embodies the invention set forth in the Westinghouse Patent in suit, as I understand that invention to have been explained by the Circuit Court and the Circuit Court of Appeals in the suit brought under this patent by the Westinghouse Electric and Manufacturing Company against the Union Carbide Company.

In the opinion of the Court of Appeals it is stated:

"the patentee seems to be entitled to claim the means by which the external and internal surfaces of the heat-producing parts of a converter were cooled by such an arrangement and separation of parts as would permit the circulation about them of oil, and the means for the retention of said oil within and about said surfaces, whereby the heat from the oil radiated to the surrounding air. If there is any doubt upon the question of patentability, the practical and commercial results of this improvement must resolve such doubt in its favor."

The commercial and practical results to which the opinion refers have been, in fact, of extremely great importance. By the use of apparatus constructed according to the specification of the patent, it immediately became possible largely to increase the capacity of transformers, and thus a great enlargement of their application in suit resulted.

In my opinion, the apparatus shown in the exhibits under consideration possesses precisely the novelty referred to in the extract which I have quoted from the opinion of the Circuit Court of Appeals. By designing and constructing a transformer of the
136 Wagner Company so that spaces are left between the coils and the interior surface of the body of the iron as well as

between the coils themselves, there is realized "such an arrangement and separation of parts" as is referred to in the above quotation from the opinion, and which secures the contemplated results in the same way.

Furthermore, the opinion of the Court of Appeals specifically says regarding claim 4:

"This claim covers such an enclosing case as will confine the non-conducting fluid, and such open spaces in the core as will permit the circulation of the liquid through them."

The apparatus of the Wagner Company as illustrated by the exhibits, clearly contains the enclosing case filled with non-conducting fluid referred to in this quotation, and likewise the open spaces which permit the circulation of this fluid through them and by means of which the contemplated end is secured. I find in the apparatus of the exhibits everything substantial that characterizes the Westinghouse invention as thus defined in the opinion of the Circuit Court of Appeals.

Comparing the particular form of converter described in the Westinghouse Patent in suit with the apparatus shown in the exhibits under consideration, and with that whose use was enjoined by the decision of the Circuit Court of Appeals, above referred to, I observe between the apparatus of the exhibits and the others only a single point of difference, which, in my opinion, is in no way material to the construction and mode of operation of the apparatus. In the apparatus of the Union Carbide Company there were horizontal channels in the core, while in the Wagner apparatus vertical channels are made by leaving a suitable space between the coils and the iron. These channels are secured by making the empty spaces within the core; that is, the core openings through which the coils
137 are to pass, larger than is required for this purpose and larger by such an amount as will all allow a free circulation of the oil which is to surround the coils and core.

In fact, the only difference between the apparatus of the Union Carbide Company and the apparatus of the exhibits is that in the former horizontal channels through which the oil can circulate were made by separating the iron plate composing the core into groups or bunches, while in the latter vertical channels are produced by making the core openings larger than is necessary to contain the coils. Each apparatus contains open spaces which fulfill precisely the same end in both—viz., to secure a circulation of the non-conducting fluid through them. I do not overlook the fact that in the apparatus of the Union Carbide Company the channels are horizontal and formed by leaving gaps, as it were, in the core, while in the apparatus of the exhibits the channels are vertical and formed by leaving spaces between the coils and the interior of the core, but I regard this difference as entirely immaterial and in no way affecting the substantial identity of the two devices.

Indeed, the patent in suit clearly shows the longitudinal open spaces in the core which defendant uses, as well as transverse open spaces between the groups of plates, and these longitudinal openings shown in the figures of the patent, just as in the Wagner Company's

transformers, are a part or portion of the openings for the coils which are purposely largely beyond the size required for the coil to permit the circulation of the oil. The spaces left (referring to the patent), by separating the secondary and primary coils (line 65 et seq.), extend, of course, from end to end of the core, and whether the coils be separated by blocks or by tubes, the spaces so left are open spaces in the core just as much as are the transverse spaces between the groups of core plates.

I will also remark in this connection that Mr. Westinghouse, in his apparatus, took advantage of the tendency of heated oil
138 to rise—that is, to move vertically—by arranging the more numerous ducts in the particular construction illustrated in Figs. 1 and 2 of the patent, between the groups of core plates, as that happens to be the vertical direction; but where the plane of the core plates is horizontal, as in defendant's device, the ducts, if vertical, which is the preferable condition, must be perpendicular to the plane of the core plates and the most natural way to form them is the way the defendant has chosen, even there, following the direction of the Westinghouse Patent with regard to the coil openings.

In view of the various considerations which I have stated, it seems to me that defendant's apparatus, as exemplified in the exhibits, referred to in the question, is substantially identical in all material respects with the apparatus set forth in the Westinghouse Patent in suit, and particularly claimed in the fourth claim thereof.

5 Q. Have you read the expert depositions heretofore given in this cause—to wit, that of Doctor Sheldon on behalf of the complainant and Dr. Nipher on behalf of the defendant—and are you familiar with the patents discovered by Prof. Nipher, and with the record and opinions in a former suit upon this patent—to wit, that against the Union Carbide Company?

A. I have read the depositions referred to in the question and am familiar with the patents discussed by Prof. Nipher and with the record and opinions in the suit against the Union Carbide Company.

6 Q. Are you in agreement with the opinions expressed by Dr. Sheldon with reference to the issues in this case, or do you differ from him in any respect?

A. I agree with Dr. Sheldon in the various statements which he has made in his deposition.

7 Q. I call your attention to the answer of Prof. Nipher, made in answer to the sixth direct question to him, and in which he
139 states his understanding of the invention set forth in claim 4 of the patent in suit. Please state whether you agree with his opinion?

A. I do not agree with Prof. Nipher in his understanding of the invention set forth in claim 4 of the patent in suit, as I understand his statements. I fail to find, however, in what he says anything that seems to me a clear and distinct statement in reply to the question which he is answering. Most of his answer under consideration is devoted to a statement of what would have resulted if inventors preceding Westinghouse had done what confessedly

they did not do, and what there is no evidence that they ever thought of doing, and I am forced to infer, from imaginings of this character, in what precisely Prof. Nipher considers the invention of the patent in suit to consist. I infer, however, from his statements, that he considers the Westinghouse Patent to set forth merely a transformer like that of Stanley's (in which the bobbins of an induction coil are arranged upon its core with spaces separating them from one another) but immersed in *oil*.

Now, it seems to me entirely immaterial as to what would have happened if pre-existing separate elements had actually been combined when nobody had thought of combining them or realized that by such combination important and highly desired advantages could be secured. The structure employed by Stanley was not designed to avoid overheating of the apparatus, and there is no intimation in his patent that any necessity for doing this was apparent to him.

Moreover, I do not think that Prof. Nipher is justified in the statement with which he concludes his answer under consideration. He says:

"The inventor of the patent in suit did not obtain a new result, but he did obtain a better result by his improved combination."

From the context I understand that he intends this to be
140 a paraphrase of, or at least his conclusion as to the meaning of the Court of Appeals in the statement which he quotes from the opinion, viz:

"If there is any doubt about the question of patentability, the practical and commercial results of this improvement must resolve such doubt in its favor."

I entirely fail to see any indication that the Court of Appeals held any such view as that which Prof. Nipher states in the concluding sentence which I have quoted from his deposition. On the other hand, it seems to me that the Court recognized the fact that Mr. Westinghouse, by the invention under consideration, did secure what was substantially a new result, and did what had not been done before, and that such was the case in fact seems to me absolutely beyond question. Nor does Prof. Nipher adduce a particle of evidence to the contrary. The very fact that he is obliged to content himself with imagining what might have been done if it had occurred to inventors prior to Westinghouse, seems to me to make the value of Mr. Westinghouse's invention only the more evident.

It is true that the invention seems a simple one, once it has been made, but that is the case with some of the greatest inventions. Mr. Westinghouse showed what was not previously apparent to any one, that by the use of a suitable insulating liquid with suitable open passages, so placed as to allow access of the liquid to the heated core and coils of the transformer, such circulation could be made as to enable the heat to be transferred from these to the enclosing case, and thence to surrounding space by radiation. There is no evidence cited by Prof. Nipher, or so far as I know in existence,

that any suggestion or intimation to this effect had been made prior to the invention of Westinghouse under consideration.

This being the case, I think Prof. Nipher is entirely unjustified in attempting to belittle the invention, as he does, and in
141 endeavoring to limit it to a specific construction which is not imposed upon it either by the statement in the patent or the state of the art.

8 Q. I call your attention to the 13th direct question addressed to Prof. Nipher and ask whether you agree with his conclusion in regard to the British Patent 9728 of 1887, which appears to have been taken out from the communication from Mr. Westinghouse?

A. I am unable to agree with Prof. Nipher in his conclusions as to the bearing of the British Patent in question upon the Westinghouse invention.

In fact, I entirely fail to see what relevance this English Patent has in connection with the present suit.

The patentee of the British Patent gives a specific and detailed description of a particular construction of the core and coils of a transformer, which construction is substantially that employed by defendants. This specific construction is particularly claimed. There is no similarity between this English Patent and the Westinghouse Patent in suit. They are for entirely different inventions. The British Patent in no way sets forth the use of oil or equivalent material and does not describe any means of avoiding the harmful effect of overheating, nor does the apparatus do this. The British Patent concerns itself with particular structures which it specifically and clearly describes. It relates only to details and structure. On the other hand, in the United States Patent in suit there is set forth a much broader invention in which these specific details are of less consequence, and more inclusive language is employed. But whatever the origin of the particular language employed in each case may be, I don't see that the fact is of any importance that in one case a more minute description is given than in the other.

The thing of importance is not what is said in a British Patent for another invention, but what is said in the patent in suit regarding the present invention.

In the specification of the patent in suit the patentee de-
142 scribes the construction of his converter. He describes the building up of a core from plates which contain two rectangular openings through which the wires of the cores pass. He says that the plates of which this core is constructed may be divided into groups separated by intervening spaces, and that "preferably" this should be done. This, however, is not a mandatory requirement, but is merely permissive.

He likewise states that preferably the primary and secondary coils may be separated in a like manner. This, again, is permissive and not mandatory. So far as direct statements go, either one of these, or both, may be employed in the converter which, in either case, would embody the invention set forth. There is absolutely nothing in the specification, so far as I can see, to limit the invention set forth to either of these particular arrangements.

As I understand it, an apparatus possessing either of these structures under consideration would embody the invention set forth in the fourth claim of the patent. This refers to

"An electric converter constructed with open spaces in its core," enclosed in a case and surrounded by a non-conducting fluid, adapted to circulate through these open spaces and about the converter.

Prof. Nipher seeks to exclude from the invention set forth in that claim, as I understand it, all devices, except such as possess cores made up of groups of plates, that is, the first specific arrangement described in the patent. He does not consider it to include an apparatus not possessing this particular structure but which does possess the separation of the coils, equally described in the specification. I cannot agree with him. It does not seem to me to be the question whether or not one could better the language of the fourth claim by making it more specific or otherwise, but rather whether the language of that claim is such as to include
143 within its scope both forms of device referred to in the specification. Professor Nipher does not question that each attains the object which the invention was designed to secure. Moreover, it is to be remembered that this specification was written when the art of the construction transformers was in its very infancy before any definite nomenclature had come into existence and when inventors did not find ready-made terms at hand wherewith to designate the structures which they had to describe. To me it seems clear that Mr. Westinghouse meant to set forth and claim in the fourth claim under consideration both forms of structure which he describes. As I have already said, he speaks of the "openings" in the plates of which he constructs his core. In the eleventh claim of the British Patent under consideration, the patentee describes a core of the structure in question as "having rectangular openings," and says that the primary and secondary coils are "within said openings." Also in the ninth and tenth claims of the same British Patent he says that the core surrounds the coils. From this I certainly infer that the coils are within the core and certainly if the coils are within the core, the air space immediately back of them is within the core. In fact it seems to me perfectly natural in connection with a core of the form mentioned to speak of the oil spaces as being "within the core" or as being "in the core." And equally natural and proper in my opinion is it, to apply this term to the channels which may be left between the coils and the core.

We are not here talking of mice and snakes or of quadrangles of houses with which Prof. Nipher confuses the question. The language of the English patent irrelevant as I think that patent to be to the subject of the present suit, is, nevertheless, of service as showing the sense in which in the art of electrical transformers the terms which we have under consideration have been used.

Adjourned to Wednesday, September 23, 1903, at 10:30 A. M.

144 NEW YORK, *September 23d*, 1903.

Met pursuant to adjournment.
Present—Counsel as before.

Direct examination of Prof. CROSS continued:

9 Q. I call your attention to X Q. 20 of Prof. Nipher's deposition, which reads as follows:

"20 X Q. Does any one of these prior patents, whether in the former record or not, when taken by itself, show: (1) In combination, an electrical converter, constructed with open spaces in its core, said open spaces being formed by blocking apart the core plates into groups, an enclosing case and a non-conducting fluid in said case adapted to circulate through said spaces and about the converter?"

Please state whether you agree with defendant's expert in his admission that there is no one patent showing all of these things mentioned in this question, in combination?

A. I do agree with Prof. Nipher in his admission, as stated in the question. Certainly, there is no patent which shows in combination the various elements referred to in X Q. 20 to Prof. Nipher.

10 Q. I call your attention to X Q. 21 of Prof. Nipher's deposition, which reads as follows:

"21 X Q. Does any prior patent to which you have referred, whether in the Union Carbide record or not, exhibit, in your opinion, when taken by itself:

(2) The combination of an electrical converter constructed with open spaces in its core, said open spaces being formed by enlarging the coil opening to a greater size than is required for the coils, an enclosing case and a non-conducting fluid in said case adapted to circulate through said spaces and about the converter?"

145 Please give reasons for any agreement or disagreement of opinion which you may have with respect to the answer to that question?

A. As I understand Prof. Nipher's answer referred to, he does not consider that it is possible in any sense to designate the open spaces which exist when the coil opening of the converter is of a larger size than is required for the coils, as open spaces in the core.

I cannot agree with him in this view, and I have given reasons for holding an opposite view in my answer to direct-interrogatory 8.

In the Westinghouse Patent in suit the core is described as being built up of plates constructed with rectangular openings through which the wires pass. It would certainly seem most natural when the core is completed by building up in this manner, to speak of the rectangular openings in the collection of plates thus assembled, as rectangular openings in the core, and in like manner, to refer to the channels which remained when the section of the coils is less than that of the core openings, as openings in the core.

British Patent No. 9728 of 1887 to Thompson, communicated by Westinghouse, to which both Prof. Nipher and myself have already made reference, gives further illustration of the use of terms. The

specification of that patent refers to the structure of a shell converter of the character of that described in the patent in suit, as consisting of two coils "surrounded by plates of iron." Certainly, if the plates of iron, and consequently the core constituted by the plates surround the coil, those coils lie within the core. The coil openings are within the core, and whatever portion of these openings is not filled by the coil is likewise within the core. Furthermore, the language of some of the claims of this British Patent is instructive. Thus, claim 1 refers to a core composed of E-shaped plates which are described as being "symmetrically disposed about a coiled conductor." That is, the coils are placed in the open spaces within the E. Now, if these plates and the core which they constitute
146 lie about a coiled conductor, that coiled conductor necessarily lies within the core and in the spaces of that E-shaped core. Certainly, these spaces may properly be spoken of as spaces in the core, and such portions of these spaces as may remain unoccupied by the coils are likewise spaces in the core.

Claim 2 of the same patent describes the core of a transformer built up of E-shaped plates, which are described as "being provided with three projecting tongues, one situated within and the others without the coil, as set forth." In this case, evidently, the coil is wound about the middle projecting tongue of the E. This tongue is described as situated "within" the coil. It is clear that this does not imply that the middle tongue penetrates the material of the coil itself, but merely that it fills space in the coil opening, that is, the projecting tongue which lies in the coil opening, is spoken of as being situated within the coil.

It seems to me that the language of this claim, which I judge Prof. Nipher to have overlooked in his consideration of this British Patent, shows the lack of pertinence of such illustrations as those cited by him in his answers to direct question 13 and cross-question 8. He thinks it beyond discussion, apparently, that if a flexible thing is coiled about some other thing, the latter thing cannot be spoken of as being "within" or "in" the former, and cites as a conclusive illustration the case of a snake which has wound itself around a mouse. He thinks it would be absurd to speak of the mouse in this unfortunate condition as being "in the snake." But in the second claim of this British Patent, which he has himself cited, there is a flexible thing—namely, the coil conductor—which surrounds another thing, one of the projecting tongues of the E-shaped plate. This tongue is spoken of as being within the coil. So that, however it may be with the mouse and the coiled snake, there is certainly no impropriety in speaking of the metal tongue and the coils of wire which surround it; at least that expression is used in this British Patent, and I think no one would
147 question that the use of language in the claim under consideration is correct and clear.

It seems hardly worth while to dwell upon this matter, but I have made this reference to the mouse and snake illustration of Prof. Nipher, because it illustrates a point which he seems to overlook, that is, that we apply the same words, and, perhaps, especially the

the same propositions in quite different ways, according to the matters discussed. So that the same proposition may convey quite a different idea in one case from that which it conveys in another case. Since snakes eat mice, if one says that a mouse is "within" or "in" a snake, we natuarlly think of the mouse as occupying the stomach of the snake. On the other hand, since the usual position of at least a portion of a core of a transformer is in the central cavity of the coil, when such a core is said to be "within" or "in" the coil, we understand it to occupy the coil opening, and not to penetrate the body of the coil itself.

Again, in the fifth claim of the same British Patent, the metal of the core is spoken of as "surrounding the holes." If the metal surrounds the holes, it seems to me that the holes must be holes in the metal, and this, whether the coils be moved or whether the coils being in place, the holes in the metal being larger than the coil sections, are not quite filled up.

Again, in claims 9 and 10 of this patent the core of soft iron is spoken of as "surrounding" the coils. It certainly follows from this that the coils are within the core, and that the coil spaces are spaces in the core, and that whatever may be left of those spaces unfilled by the coils when these are in place are spaces within or in the core.

To me the statement in cross-interrogatory 8 to Prof. Nipher, describing the combination under consideration, apart from all discussion with regard to particular wording, is entirely clear, and from his answer to cross-interrogatory 9 I understand that the character of the structure intended was understood by him. It is un-
148 questionably a fact that no such structure in an electrical converter was shown in any patent or publication prior to the Westinghouse Patent in suit. The combination stated in cross-question 8 to Prof. Nipher is clearly and specifically set forth in that Westinghouse Patent, and in my opinion such a structure embodies the apparatus set forth in claim 4 of that patent.

In view of what I have said in this answer, in connection with which should be considered portions of my last preceding answer, which it is hardly necessary to repeat, I disagree entirely with Prof. Nipher in his answer to cross-interrogatory 8.

11 Q. Please state whether the spaces in the defendant's construction, which are referred to as "oil ducts" in "Complainant's Exhibit Wagner Catalogue," are "open spaces in the core" of the transformer therein referred to; also whether the bounding surfaces of these spaces are "internal surfaces of the heat producing parts of a converter?"

A. In my opinion the "oil ducts" referred to in the question are unquestionably "open spaces in the core" of the Wagner transformer. My reasons for holding this opinion have been stated at length in preceding portions of this deposition, so that I will not repeat them here.

Also, in my opinion, the bounding surfaces of the spaces referred to are "internal surfaces of the heat producing part of a converter." The walls of the coil openings evidently constitute the internal surface of the core within which heat is generated in the operation

of the apparatus, and when the coils are in place these walls form a boundary to the ducts, the coils, of course, forming another portion of that boundary; that is, those portions of the coils which lie within the core.

12 Q. Please state your understanding of the word "opening" as used in the patent in suit? You may consider, in making your answer, the matters referred to by Prof. Nipher in answer to X Q. 14.

A. I understand it to be applied to designate a space which is not filled up. Thus the plates of which the cores are
149 constructed are said to possess "rectangular openings." Also, in the first claim, the space between the primary and secondary coil is called "an open space." In the second claim the spaces between the groups of laminæ of soft iron which constitute the core are said to be "separated by open spaces." In the third claim the tubes which may be used to keep the groups of laminæ separate, are referred to as "open tubes." The fourth claim refers to "open spaces" in the core of a converter, and as I understand that claim, the term "open spaces" refers equally to spaces left between groups of laminæ constituting the core when this construction is used, and to the open spaces between the coils or between the coils and the internal walls of the core, in case this structure is employed.

In all cases the patent seems to employ this term in the sense in which it is defined in the quotation cited from the Century Dictionary, namely, as

"An open or clear space affording approach, entrance or passage,"

and also in the sense of a particular definition from that dictionary, preferred by Prof. Nipher:

"A breach or gap, a hole or perforation, an aperture, specifically in architecture, an unfilled part in a wall left for the purpose of admitting light, air, etc."

It seems to me that this definition comprehends all of the forms of spaces utilized as ducts, both in "Complainant's Exhibit Westinghouse Model" and in "Complainant's Exhibit Wagner Model."

13 Q. Please consider Prof. Nipher's answers to X Q.'s 33-36, inclusive, and state whether you agree with, or disagree from, the several positions taken by the witness in these answers; you may, in giving your answer, state the reasons for any opinions you may express?

150 A. I find it a little difficult in reading Prof. Nipher's answers referred to, to know precisely what his opinion really is regarding certain of the matters inquired about. In his answer to cross-interrogatory 33 he criticizes the wording which is employed to describe the combination therein referred to, but so far as I can see, setting aside the words used to designate the structure, and considering the structure itself, which he evidently understands, he admits that no patent or publication prior to the patent in suit disclosed that combination.

As I have explained at length in preceding portions of this deposition, it seems to me that the ducts formed in the manner described in cross-question 33 are properly designated as ducts in the core of

the converter. Prof. Nipher thinks otherwise, and we are here in absolute disagreement.

Prof. Nipher cites various patents, as Stanley United States Patent 349,612 and Stanley United States Patent 349,616, Westinghouse English Patent No. 7928 of 1887, Hindley & Buffham's United States Patent No. 266,390, Thomson's United States Patent No. 360,123, Millar's Patent of 1883. Now there is in none of these anything approaching the combination referred to in cross-interrogatory 33 and in cross-interrogatory 36, and Prof. Nipher is not ready to assert, and in view of his own statements could not assert, otherwise. With regard to these patents it seems to me sufficient to say that they none of them do more than represent elements which may exist in the combination which is the subject of the Westinghouse Patent in suit. With the light of our present knowledge and in view of the opinion of the Court of Appeals in the Union Carbide case, it seems to me idle to speculate as to what would have resulted if, prior to Westinghouse, somebody else had combined these various elements. In saying this, however, I do not wish to be understood as assenting to all that Prof. Nipher says with regard to such imaginary combinations, but simply to indicate
151 why I do not prolong this answer by entering into an extended analysis of his statements.

Direct examination closed.

Cross-examination by Mr. FOWLER:

14 X Q. Be kind enough to designate in the patent in suit—I mean the specification or the drawings thereof—any provision for spaces between the coils and the core, or any suggestion therein that there is any open space between the coils and the core?

A. There is no specific direction given for the particular structure to which you refer. The specification however describes a structure in which groups of core plates are separated by such spaces, and a structure in which the coils are separated by like spaces. This is abundantly sufficient to indicate the application of the invention. It is an obvious application of the same principle and method of construction to separate the coils from the core, as indicated in the question, and as I have explained in my answer to direct-interrogatory 4, the natural method of securing the desired ducts in which the heated liquid is to circulate, in an apparatus in which the plane of the core plates is horizontal, is to provide such spaces as are referred to in the question.

15 X Q. Do you find in the defendant's structure the combination of a soft iron core, and parallel primary and secondary coils having an open space intervening between them?

A. It seems to me that defendant's structure contains what is substantially this combination. In it there are two sets of primary and secondary coils, which are parallel to each other. Each of these parallel sets of coils contains a low potential secondary which is placed betwen the two high potential primaries. The primaries and secondaries in each group are to a certain extent separated

from each other, to judge from Fig. 341 of the Wagner Company's Catalogue, though the exhibit "Wagner Model"
152 shows them in close contact. The two groups of coils are parallel, and are separated by an intervening space, and this last mentioned fact seems to me to constitute defendant's apparatus a structure of this character. In making this statement I am not considering the combination specified in relation to any patent, or to anything outside of the question, and I should not wish to have my words interpreted as having any reference or bearing beyond this.

16 X Q. Do you find that the patent in suit contains any statement or recommendation that the open spaces in the core shall be vertical?

A. I don't observe any verbal statement to this effect, but that is the natural mode of placing them, in view of the end to be secured, the lettering of the figures seems to me to imply that such a position for the ducts should be chosen. It seems to me that the lettering of the figures is in fact a virtual recommendation to put the tubes or ducts in a vertical position.

17 X Q. Are you acquainted with Mr. W. J. Jenks, who testified as expert for this complainant on this patent in the Union Carbide suit?

A. I have been acq-ainted with Mr. Jenks for some twenty years, or nearly that time.

18 X Q. Have you conferred with Mr. Jenks relative to this patent, and particularly claim 4 thereof?

A. I don't recall that I have done so.

19 X Q. When did you last see Mr. Jenks?

A. I don't remember precisely; the last time that I distinctly remember seeing him was some time last winter, though I may possibly have seen him in the spring.

20 X Q. In your answer to Q. 3 you stated, did you not, "the patent under consideration describes for the first time a transformer in which, by the use of oil or an equivalent fluid, either liquid or gas, the coils and core of a transformer in operation are kept cool," etc. You then corrected yourself, and omitted the words "either liquid or gas"; what was your object in omitting the word "gas" or in striking out the word "gas" in your answer, when
153 claim 4 of the patent in suit says "and a non-conducting fluid or gas in said case adapted to circulate through said spaces and about the converter"?

Objected to as irrelevant and immaterial.

A. Until you called my attention to the fact of the erasure in my deposition, I was entirely unaware of its presence. Undoubtedly the reason of my altering the wording was that, as soon as I had finished the erased clause, I saw that it was tautological. The term fluid, as is well known, applies either to a liquid or a gas, and, having said "an equivalent fluid," it seemed to me that the erased clause was superfluous, and, as I have said, tautological. My meaning might be equally well expressed by using the expression "oil or

an equivalent liquid or gas" rather than "oil or an equivalent fluid." In the statement referred to in your question I did not attempt to employ the language of the claim, but desired simply to state certain facts in my own words. Of course, the meaning of the expression "a non-conducting fluid or gas" in the fourth claim of the Westinghouse Patent in suit is perfectly clear.

21 X Q. Are you familiar with Stanley Patent No. 349,612 of September 21st, 1886, one of the prior patents introduced in the Union Carbide case and in this case on behalf of the defendant?

A. I am acquainted with that patent.

22 X Q. Was the reference to a non-conducting gas omitted from the answer to which I have called your attention because of this Stanley Patent?

Objected to as irrelevant and immaterial.

A. It was not. It seems to me that such a question as the present one ought hardly to be necessary in view of my answer to cross-interrogatory 20. As I have explained therein, the expression "oil or an equivalent fluid" has absolutely the same meaning as
154 the expression "oil or an equivalent liquid or gas" or the expression "oil or an equivalent fluid, either liquid or gas." It can hardly fail to be evident on reading the complete statement in my answer to question 3 to which you refer in cross-question 20, that the Stanley apparatus referred to has no relation to the combination which I described. I do not find in this patent to Stanley any reference to difficulties arising from the heating of the coils and cores of a transformer, or any indication that the patentee devised his particular structure with this in view.

23 X Q. I notice in this same answer to Q. 3 of yours, that you have corrected yourself in another particular. You originally said, "the specification of the patent under consideration sets forth the use of intervening spaces which separate from one another different portions of the core, or which separate the primary and secondary coils of the transformer from one another," and you change your answer to read "which separate from one another the different working portions of the apparatus, etc." What led you to make that change in your original statement?

A. I did not make any change in my original statement, because that was not completed when I changed the form of the sentence. This statement was not prepared beforehand as to its wording, and after I had proceeded through the erased portions, it seemed to me that my sentence would be clumsy, and that by altering its form I could make the statement clearer. I felt at liberty to do this, not having completed my answer. I do not see that the alteration has made any change in the sense of the statement. If it has done so, the statement which I intended to make is the statement which I have made.

24 X Q. In answer to Q. 4 you refer to "the interior surface of the core." Will you please designate or point out what is the interior surface of the core?

A. As I understand the question, it refers to my statement, "Like-

wise the sets of coils are each set off and separated from the
155 core so that the interior surface of the core is in direct contact with the oil." By the "interior surface of the core" I mean the surface which forms the boundary of the coil openings.

25 X Q. In answer to Q. 4, you say, "By the use of the apparatus constructed according to the specification of the patent, it immediately became possible largely to increase the capacity of transformers, and thus a great enlargement of their application resulted." What do you understand caused this increase of capacity; do you understand it was due to separating the groups of core plates from one another, or that it was due to separating the coils from one another, and from the core, or to these features combined?

A. Each of these features, of course, played its part. I have not attempted to assign to each its particular importance, nor do I think that is material to the subject under consideration. The application of the principle set forth in the Westinghouse Patent in suit, and the employment of the combination described in that patent, is admitted to have enabled constructors to employ transformers of much greater capacity than had previously been possible.

26 X Q. Your idea, then, as I take it, is that claim 4 of the patent in suit covers all these features which I have referred to in X Q. 25?

A. I understand that an apparatus would embody the invention set forth in that claim if its coils and cores were separated and placed as suggested in X Q. 25, understanding, of course, that these are placed in the enclosing case of the claim and surrounded by the non-conducting fluid or gas referred to in that claim, and adapted to circulate through the spaces referred to and about the converter I assume, of course, that such separation of parts as is referred to results in the formation of ducts through which the fluid circulates.

27 X Q. Which feature is the more important; separation of the core or the separation of the coil, for the purpose of cooling the transformer?

A. I am not ready to answer this question, as I am unable
156 to state which, broadly speaking, is the more important. I doubt if the question is susceptible of a catagorical answer; moreover, because I think that one or the other of the arrangements might be the more important, according to individual circumstances and conditions.

CHARLES R. CROSS.

Cross-examination closed.

Adjourned, at request of counsel for complainant until Friday, September 25th, 1903, at 11 a. m.

NEW YORK, *September 25th*, 1903.

Met pursuant to adjournment.
Present—Counsel as before.

Deposition of V. S. Beam.

VICTOR S. BEAM, a witness produced on behalf of the complainant, having been duly sworn, deposes as follows in answer to interrogatories by Mr. Cooper:

1 Q. What is your name, age, residence and occupation?

A. Victor S. Beam; age, 27; residence, New York City; occupation, electrical engineer.

2 Q. Have you, at my request, visited the plant of the Union Carbide Co. at Niagara Falls, N. Y., for the purpose of examining the construction of certain transformers at that company's plant, and purporting to have been manufactured by the Wagner Electric Manufacturing Co. of St. Louis, Mo.?

A. I have.

3 Q. Did you examine any of those transformers, and if so, please state the facts regarding such examination, and particularly the construction of the transformer which you examined with
157 reference to the use of spacing strips between the coils of the transformer, and between the coils and core?

A. I examined one of these transformers, the oil having been taken off to a level, so that I could examine the arrangement of the coils with respect to each other and to the iron core which surrounded them, and found that there were four wooden wedges, each about three-eighths of an inch thick, between adjacent coils of the transformer. These wedges were placed at equidistant points along the width of the coils, and were about seven inches apart. The coils, or rather the insulation at the side of the coils, bulged somewhat between these wedges, so that the width of the air space between coils was somewhat less than three-eighths of an inch, and in some places was only about one-eighth of an inch. There was a strip of insulation between each outside coil and the side of the core against which it abutted. This insulation was about an inch thick, and was of the same general shape as each of the coils of the transformer. Between this sheet or strip of insulation and the side of the core, in each half of the transformer, was a narrow strip of wood about one-tenth of an inch thick. This kept the insulation about one-tenth of an inch away from the core for a short distance on either side of the strip, but at points further removed from the strip the coils and insulation bulged so that the insulation took up practically all the space between the coils and the core at those points. Along the ends of the coils and between the same and the core, and between the same and the core at that place, a sheet of insulation also about one-eighth of an inch thick was inserted, and between this insulation and the core two strips of wood, each about one-tenth of an inch thick, were placed. This insulation was tightly wedged at most places between the ends of the coil and the core.

4 Q. When was it that you made this visit and inspection?
158 A. It was August 24th, 1903.

5 Q. Please state whether these insulating strips projected above the ends of the coils, or where they were contiguous to the iron core, whether they projected above the iron core?

A. These wedges between the coils did not extend above the tops of the coils, and those between the coils and the core did not extend above the top of the core.

6 Q. When the cover of the transformer had been removed, and prior to drawing off the oil, were the spacing strips or wedges visible?

A. Those between the coils and the iron were not visible, and while those between the coils might have been seen, it would have been hard to distinguish them. With the small trap door in the top alone open, practically none of the outlines were visible.

Direct examination closed.

Cross-examination by Mr. FOWLER:

7 X Q. When had you previously made an examination of the Wagner Transformer at the Union Carbide Works?

A. September 13th, 1902.

8 X Q. What was the occasion of your examining these transformers at that time?

A. As I understand it, it was for the purpose of ascertaining just what changes had been made after the issuance of the injunction against the Union Carbide Company.

9 X Q. It is not clear to me from your answers whether you found spaces between the coils in this Wagner transformer which you say you examined in August last. Will you please be a little more explicit on that point?

A. I did find spaces between the coils. These were formed, as I have stated in my direct examination, by wooden wedges about three-eighths of an inch thick, and if the coils and insulation had
159 not bulged, there would probably have been a three-eighths inch air space between adjacent coils, but as a matter of fact the coils and insulation did bulge so that the air space between coils was much less than three-eighths of an inch.

10 X Q. By "air space" in the last answer, you mean really oil space, do you not?

A. Yes, for these transformers were normally operated with oil.

11 X Q. You did find, then, in this Wagner transformer, did you not, a soft-iron core, and parallel primary and secondary coils having an open space intervening between them?

A. Yes; there were open spaces between the coils.

12 X Q. Question repeated.

A. I found in this Wagner transformer a soft iron core, and parallel primary and secondary coils having an open space intervening between them.

13 X Q. Do you remember submitting an affidavit in the case of the Westinghouse Co. against the American Transformer Co., in the District of New Jersey, involving this same patent, in the month

of January last, and saying, regarding the Wagner transformers at the Union Carbide works,

"The arrangement was such that the coils completely filled the openings in the core plates, there being no room whatever for the circulation of oil through the core plates either transversely or vertically?"

Complainant's counsel asks defendant's counsel to submit to the witness the alleged affidavit, or a copy of it, to which he has referred.

Copy of the affidavit handed to the witness by defendant's counsel.

A. I do.

14 X Q. Do you wish to affirm or to deny that statement in that affidavit now?

A. I wish to affirm that statement now, as I am still of the
160 opinion that in the transformers which I examined on September 13th, 1902, there was no space for the circulation of oil through the core plates either transversely or vertically, and that the coils completely filled the openings in the core. I remember examining these transformers to see if there was any appreciable space between the coils and the core, and found none, and still believe that there was no appreciable oil spaces between the coils themselves.

15 X Q. The Wagner transformer which you examined at the Union Carbide Works in August last, did have appreciable space between the coils and the core, did they not?

A. They were hardly appreciable for the circulation of oil, especially those between the coils and the iron.

16 X Q. The testimony which you have given to-day concerning the examination which you made in August last, relates to but one Wagner transformer, does it not?

A. Yes.

17 X Q. Prior to your examination of the Wagner transformer in September, 1902, you had made another or other investigations of the Wagner transformer at the Union Carbide Works, had you not?

A. I had never been at the Union Carbide Works prior to September 13th, 1902, and had never seen the transformers in question before that time.

18 X Q. You testified in the Union Carbi*ne* cases on the patent here in suit, in March, 1901, concerning transformers, and cooling transformers by separation of the parts thereof, and with reference to transformers, both air cooled and oil cooled, did you not?

Complainant's counsel objects to this question, because the matters inquired about are not at all pertinent to the present examination.

A. I did.

19 X Q. Are you able to state how long, approximately, the Wagner Company has been manufacturing transformers, oil-
161 filled transformers, having space between the coils and the core, and between the coils themselves?

Objected to as wholly incompetent.

A. No, I do not think that I am.

20 X Q Were you aware in March, 1901, when you testified in

the Union Carbide case, that the Wagner Co. were at that time making oil-filled transformers having spaces between the coils and the core, and the coils themselves?

A. No.

21 X Q. Were you aware at that time that the Wagner Co. were making such transformers, the same being enclosed in a case, and the casing being filled with air.

A. No.

22 X Q. But you were aware, were you not, at that time that the Wagner Co. were making transformers having spaces in its core formed by blocking the plates of the core apart?

Same objection.

A. I was informed that the Wagner Company had made some transformers with spaces in their cores formed by blocking the plates of the core apart.

23 X Q. Were you informed at that time, or at any time prior thereto, that the Wagner Co. had been making oil-filled transformers with open spaces between the coils and between the coils and the core?

Objected to as irrelevant and immaterial, and also because it is improper cross-examination, it appearing by the testimony of Mr. Layman, defendant's manager, that whatever the defendant was doing was done after notice of the patent.

A. I think I was informed that the Wagner Company was
162 making or had made some transformers with spaces between the coils, but I cannot be certain about it.

24 X Q. Were you aware at the time you testified in the Union Carbide case in March, 1901, that claim 1 of the patent here in suit was at that time in issue in that case, the said claim 1 reading as follows:

"1. The combination, substantially as described, of a soft iron core, and parallel primary and secondary coils having an open space intervening between them."

Complainant's counsel states that he understands the fact to be otherwise than as indicated in the question, and makes reference to the statements of counsel appearing upon page 168 of the Union Carbide record. Aside from this, complainant's counsel objects to the question as being incompetent and immaterial. The record is in evidence and speaks for itself.

Defendant's counsel states that it is true that on pages 168 and 169 of the record in the Union Carbide case, claims 1, 3 and 5 were withdrawn from consideration in that case, but that this witness testified previous to that, in the case.

A. I do not remember that I was aware whether claim 1 which you have quoted was in suit or not at the time of giving my testimony.

25 X Q. Had you any information to that effect at that time?

Same objection.

A. I was not asked to study the patent at that time, nor was I

asked to testify concerning it, and do not remember being informed that claim 1 was in suit.

26 X Q. In whose employ are you at the present time?

A. In the employment of W. J. Jenks.

163 27 X Q. Will you please state who W. J. Jenks is, and what business he is engaged in?

A. Mr. Jenks is the secretary of the Board of Patent Control, and is an electrical expert.

28 X Q. The Board of Patent Control, as I understand it, is an alliance existing between the General Electric Co. and the plaintiff herein, the Westinghouse Co., as to their patents, and represents those companies in their patent matters; is that substantially correct?

Objected to as irrelevant and immaterial, also because of incompetence.

A. I believe it is.

29 X Q. Were you in the employ of Mr. Jenks, and have you been so in his employ since you testified in the Union Carbide case in March, 1901?

Objected to as irrelevant and immaterial.

A. I was in his employ, and have been ever since.

30 X Q. You have referred in your answers in your direct examination to the insulation having bulged, and having to some extent restricted the opening between the coils and the core. This bulging which you refer to was undoubtedly caused by putting the transformers in service, was it not? In other words, they were not constructed that way?

A. No; those coils were evidently put together and still are under some lateral pressure, which, in my opinion, has caused whatever bulging there is.

31 X Q. As I understand it, you let part of the oil out of this Wagner transformer when you examined it in August last, and that you only could see the top of the core and the space which was between the coils and the top of the core; is that correct?

A. Yes.

32 X Q. When you examine the Wagner transformers in September of 1902 you didn't draw any of the oil out, did you?

164 A. No; none of the oil was withdrawn from the transformer case, but the transformer was lifted out of the oil and case, so that the entire core was visible.

33 X Q. Is it not a fact, Mr. Beam, that you have hesitated and paused a great deal in making your answers, both in your direct and cross-examination in this case?

Objected to as irrelevant and immaterial, and also as incompetent with reference to the phrase "a great deal." It is suggested by counsel for complainant that if defendant's counsel desires the Court to infer, from the manner of question which he now puts, that the witness has expressed any doubt or uncertaity in the course of his

deposition, that he put a question to the witness which will raise that matter directly.

A. No more than ordinarily.

VICTOR S. BEAM.

Deposition closed.

Complainant's counsel states that his representative has been instructed to request the Court at the call of the Equity Calendar, which it is understood will be held on September 29th, to fix a day for hearing this cause shortly after October 15th next.

Defendant's counsel states that as at present advised he shall oppose any application to the Court to hear this cause during the month of October, as he has imperative engagements, having obtained the allowance of motion for letters rogatory to take depositions in Europe before the first of November, and that it is utterly impossible for him to be in attendance on this case during the month of October, as now advised, as he expects to be in Europe during the latter half of October, or perhaps earlier.

165 & 166 In view of the foregoing, counsel for complainant states that he is willing to have the case set for argument on any day during the first half of November, 1903, that may be fixed by the Court; or if counsel for defendant should decide not to go to Europe, counsel for complainant expresses his willingness to have an earlier day set.

Defendant's cousel states that he will endeavor to have the case set at some date convenient to him in November in case he makes the trip to Europe, or in the event of not making the trip to Europe, will endeavor to have the case set down for the latter half of October.

Complainant rests.

Complainant's Exhibit
American Electrician
pp. 12, 13 & 14.

sure to 110 volts. Each panel is fitted with a voltmeter and ammeter, two switches and a Westinghouse brush-type circuit breaker.

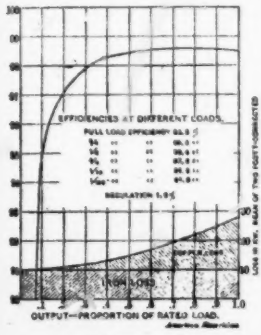


FIG. 20.—WESTINGHOUSE.

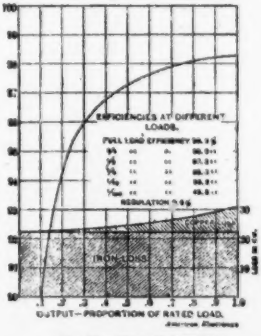


FIG. 21.—GENERAL ELECTRIC.

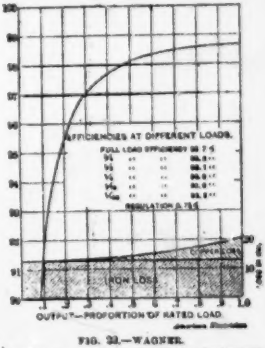


FIG. 22.—WAGNER.

EFFICIENCY AND LOSS CURVES OF THE THREE MAKES OF TRANSFORMERS USED ON THE CARBIDE TRANSMISSION. THE CURVES OF THE WESTINGHOUSE TRANSFORMERS ARE THE MEAN OF TWO CONNECTED FOR TWO-PHASE THREE-PHASE WORK AND INCLUDE THE SLIGHTLY REDUCED IRON LOSSES OF THE TRASER AND THE INCREASED COPPER LOSSES OF BOTH MAIN AND TRASER. IN COMPARING THE LOSSES OF FIG. 22 WITH THE OTHERS, THE FACT SHOULD BE REMEMBERED THAT THE WAGNER TRANSFORMERS ARE ONLY RATED AT FOUR-FIFTHS OF THE RATED CAPACITIES OF THE OTHER MAKES.

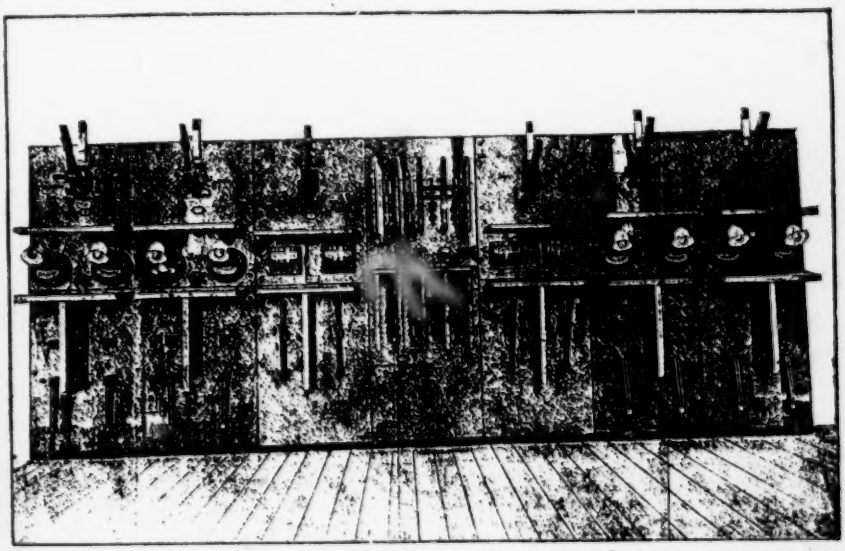


FIG. 23.—ONE OF THE TWO 22K-VOLT SWITCHBOARDS OF THE CARBIDE SUBSTATION. THIS BOARD RECEIVES IN THE MIDDLE PANEL THE OUTPUT OF FOUR OF THE 2000-H.P. STEP-DOWN TRANSFORMERS SHOWN ON THE LAST PAGE, AND DISTRIBUTES THIS OUTPUT THROUGH THE OTHER PANELS TO THE 2000-H.P. TRANSFORMERS SHOWN ON THE NEXT PAGE.

THE 2000-H.P., 2200-VOLT TO 110-VOLT TRANSFORMERS.

The transformers which still further lower the pressure to that required by the carbide furnaces are somewhat smaller than the step-up and step-down transformers mentioned above, being rated at 1500 kw. or 2000 h.p. each, while the transformers already described are rated at 1875 kw. or 2500 h.p. each. The 2000-h.p. transformers were built by the Wagner Electric & Manufacturing Company. Like the others described above, they are oil-insulated and water-cooled and are guaranteed to operate continuously at three-quarters load without the use of the water coils, dissipating all the losses by the cooling of the boiler iron case with a rise of temperature not to exceed 40° C. They are guaranteed to run under full load with a water flow of three gallons per minute with the same rise of temperature above atmosphere.

These transformers are scattered, in order to bring them near the furnaces, which is necessary on account of the low secondary voltage, each being located in a small transformer house built in the form of a lean-to beside the main structure of the carbide works. The transformer houses are designed to give liberal air circulation for cooling purposes. The covers of the transformers themselves, on account of the dusty location, are made absolutely dust-proof in all joints.

A view of one of these transformers with the exterior indicated as broken away to show the coils and core is given in Fig. 34. The coils lie in vertical planes and the laminations of the core in horizontal planes, the arrangement of the spacing blocks and the plates and clamping bolts being clear from the illustration. The 110-volt secondary comes out of the top of the transformer in a large number of heavy copper straps to which interleaved leads are bolted for carrying the current to the furnaces. The copper bars forming the leads are interleaved (i. e., those of one polarity are interspersed between those of the other polarity) in order to reduce the self-induction and particularly the skin effect which would be very serious were this amount of current (between 13,000 and 14,000 amperes) carried with all the conductors of one polarity in one group and all the conductors of the other polarity in another group.

The transformers are wound for a voltage ratio of 4400 or 2200 volts to 220 or 110 volts. In actual practice the windings are connected for a ratio of 2200 to 110. The parts are guaranteed to withstand an insulation test of 10,000 volts alternating between high-tension coils and iron and 5000 volts between the core and the containing case. Tests under these pressures were made on each of the transformers after it had been operating continuously for 24 consecutive hours, the duration of the tests being 30 minutes on each transformer. Each transformer is further built to withstand an overload of 50 per cent without deleterious effects of any sort for a period of five minutes. All transformers were subjected to a 30-day duty test prior to their acceptance by the Carbide Company and complete electrical tests were made at the carbide plant. The loss and efficiency results obtained from these tests are plotted in Fig. 33, the curves and figures given being the mean results of seven transformers calculated from an iron loss obtained in the usual way and copper loss obtained by wattmeter measurements.

An interesting point in connection with the tests made at the Wagner factory in St. Louis and the tests at Niagara Falls is the fact that the former showed an iron loss about 1½ kw. less than the latter. This is due to the use of a smooth-body generator in the former test, which generates a sinusoidal e.m.f. wave giving a lower iron loss than the flat-topped wave of the Niagara generators.

A few of the details of construction of these transformers are of interest. A requirement of the water-cooling coils is that they should be absolutely free of any risk of leakage since the leakage of water into the oil of the transformer would of course cause a break down of the insulation. The water-cooling coils of these transformers are of seamless copper tubing, sufficient to withstand a pressure of 325 pounds, but subjected by the Wagner Company to a test pressure of 625 pounds before shipment to the carbide plant. These cooling coils are made with welded joints inside the transformer case, and as the pressure is only a trifle above atmosphere they can be depended upon to be absolutely free from leaks. Each transformer is equipped with an oil gage for indicating the level of the oil and each oil gage has enclosed within it a thermometer which indicates the temperature of the oil at the upper surface of the oil body.

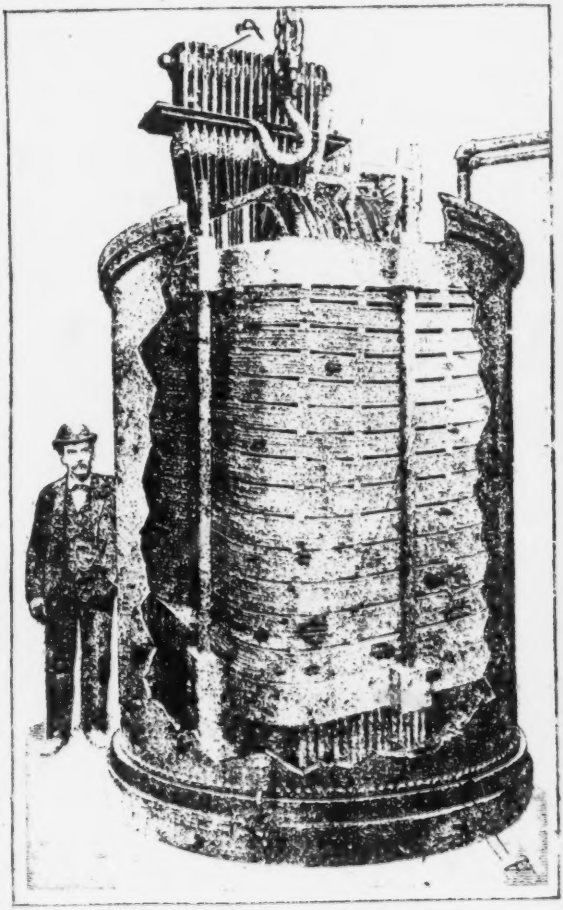


FIG. 34.—ONE OF THE TWELVE 2,200-VOLT TO 110-VOLT WAGNER TRANSFORMERS SHOWING THE INTERNAL PARTS WITH THE EXCEPTION OF THE COOLING COILS.

The 110-volt secondary comes out in a large number of heavy copper straps to which interleaved leads can be bolted for carrying the current to the furnaces. The power is metered at the primary terminals of these final transformers by indi-

ary integrating meters mounted in the transformer rooms. The primary circuits, in the same location also contain water switches for cutting off the power in case of emergency. A water switch consists of a metal pail or tank filled with water, and a cast-iron rod which can be lowered into it. This arrangement is shunted by an ordinary knife switch to obtain good contact. The arrangement is shown in the diagram of connections. In operation the knife switch is first opened, throwing the current through the rod and water. The rod is then raised, throwing the water into the path of the current and finally drawing an arc between the surface of the water and the lower end of the rod. If the water is of sufficiently high resistance, the power is cut off gradually as the rod is raised, so that there is but little arc when the circuit is finally broken. This arrangement is a highly effective one, as the arc finds little to feed upon with water

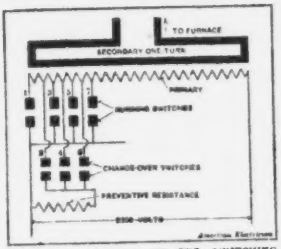


FIG. 54.—THE SCHEME OF THE SWITCHING ARRANGEMENT FOR VARYING THE RATIO OF TRANSFORMATION OF THE 37,500-AMPERE TRANSFORMER.

for making carborundum, has been at work developing an electrical process for making graphite from amorphous carbon, or coke. A small plant containing one

low resistance of both the raw material and the finished product, this pressure is very low, varying from 12 to 70 volts. On this account the transformer, which is rated at 450 kw., bears the distinction of delivering the largest quantity of electrical current of any single machine the world over. The transformer is designed to deliver its full rated power of 450 kw. at either 30 volts, 12 volts, or any one of a number of intermediate steps the rated secondary current therefore being inversely proportional to the secondary pressure. At 12 volts the current required to deliver 450 kw. amounts to 37,500 amperes.

The transformer and its accompanying switchboard are shown in the illustration reproduced on this page. The transformer itself is of the usual oil insulated and water-cooled type, cased in a boiler-iron tank about 64 inches in diameter and six feet high. Its secondary circuit natu-

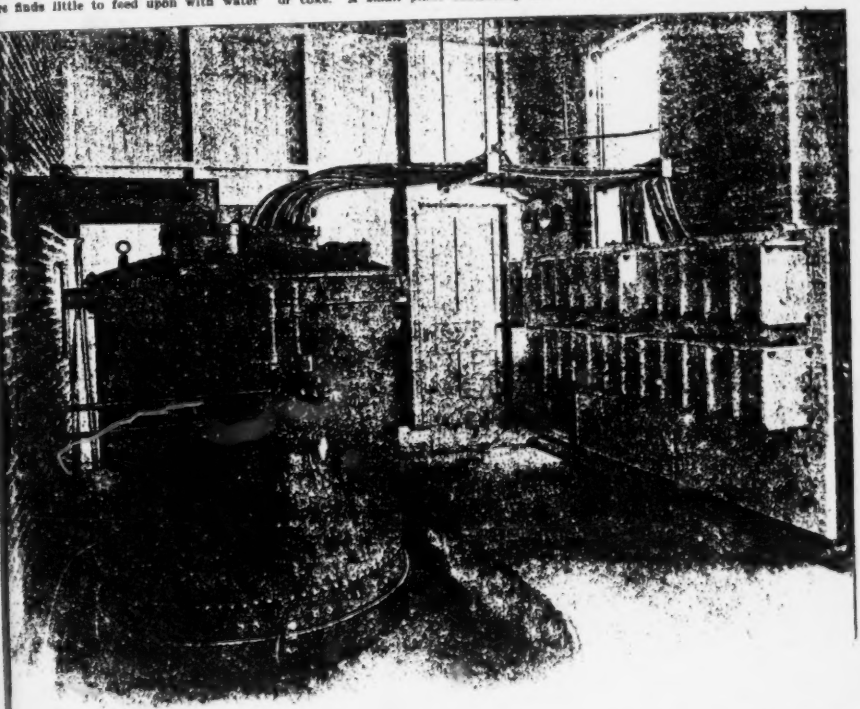


FIG. 55.—THE 37,500-AMPERE TRANSFORMER AT THE NEW WORKS OF THE ACHESON GRAPHITE COMPANY AND ITS VOLTAGE REGULATING SWITCHBOARD.

one electrode, and is not injurious to ther terminal.

A 37,500-AMPERE TRANSFORMER.

As has been previously noted in these olumns, Mr. E. G. Acheson, the discovr and founder of the electrical process

furnace has been built on the property of the Niagara Power Company, adjoining the carborundum works, an interesting feature of this plant being the transformer which lowers the voltage to that required by the furnace. Owing to the

rally consists of a single turn of very massive copper bars, and these run out through the top of the transformer to the heavy leads shown in the illustration, which run through the wall to the furnace on the other side. These leads con-

Complainant's Exhibit
Wagner Co. Catalogue

WAGNER ELECTRIC MFG. CO.

ST. LOUIS, U. S. A.

Catalogue No. 102

Bulletin No. 59 1903

TYPES "M" AND "M H" TRANSFORMERS.

DATING from December 1st, 1902, we are prepared to supply two forms of standard transformers, "M" and "M H." The first, our well known high efficiency type, and the latter a new development to meet the demand for a cheaper and less efficient form of apparatus. In all mechanical features of construction,



Fig. 338—Standard Type "M" and "M H" Transformers.

including inherent method of winding and insulation, the two forms are identical. They differ simply in the AMOUNT of copper and iron employed.

We continue to advocate the shell construction for transformers, for the reason that this form is not only the most efficient from a theoretical standpoint—all other conditions of insulation, material and temperature remaining the same—but because practical demonstration confirms the theoretical conclusions. The regulation of shell type transformers on both non-inductive and inductive loads is far superior to the best regulation that can be obtained with transformers of the core type. The relative positions of core

Another factor in the regulation of transformers is the operation on three-wire secondary, with the load on the two sides of the circuit unbalanced. The regulation of Types "M" and "M H" transformers is practically the same on three-wire as on two-wire distribution, and is not affected by an unequal distribution of the secondary load.

Temperature

All Type "M" transformers are designed for a maximum rise in temperature of 50 degrees C., and "M H" for a rise of 60 degrees, when operated continuously at full load. This increase of temperature is measured by increase in resistance of copper coils. When used on ordinary lighting load they will operate at about 40 degrees and 50 degress rise respectively.

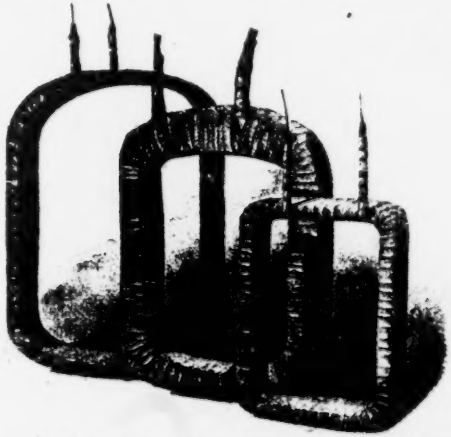


Fig. 338—One-half Set of Coils, Separated, for "M" and "M H" Transformers.

The cross section of a 15 K. W. transformer, on page 7, illustrates very clearly the excellent provision that has been made for cooling *primary* and *secondary* coils, and *iron*, by keeping up a natural circulation of oil. This is one of the most important advantages of the shell type transformer. These oil ducts are so proportioned and so placed that, while they keep all parts of the transformer cool, and thus prevent deterioration of insulation and reduce ageing of iron to a minimum, they cause a minimum loss in efficiency.

In the *shell* type transformer the iron is the coolest part, while in the *core* type it is the *hottest.* Therefore, in the use of shell transformers, the temperature of the coils can be taken as the highest temperature of the transformer, while in the core type of transformer the iron or steel is even hotter than the hottest part measured by the resistance method.

In a recent test on a core transformer of prominent make, the secondary was found to be over *forty per cent hotter* than the primary.

Core Loss

The next point of importance in a transformer is economy of operation, which depends not only on the total losses, but more

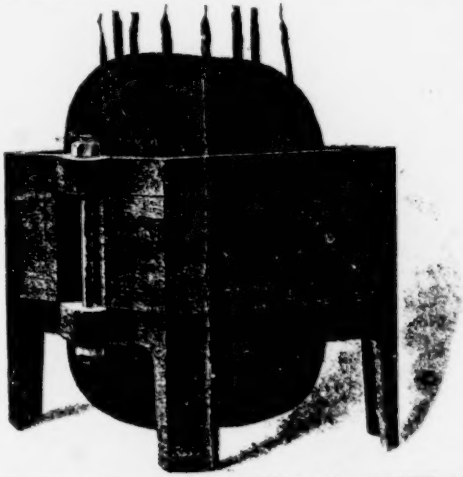


Fig. 339—Perspective View—5 K. W. Type "M" Transformer, Without Case.

particularly upon the core loss. Of two transformers with identical total losses, that one showing the lower core loss is to be preferred, because of the greater all-day efficiency obtained, and the resulting increase in economy of operation.

In this also the shell type of transformer has a distinct advantage over the core type, for, all other conditions being equal, the shell type will have the smaller core loss.

The importance to the economical operation of a central station, of testing for core loss every transformer received, cannot be overestimated. The variation in core loss of two transformers of identical design may be considerable, depending, as it does, not only upon the constituents of the steel used, but also upon the method of treatment.

Small Transformers Dry

The smaller sizes of transformers have sufficient radiating surface to liberate the heat produced, without the use of oil or other means of cooling; with these a special form of case is used, as shown in Fig. 342. Sizes above 1½ K. W. capacity are operated with oil.

Mechanical Details

The general appearance of the mounted transformer can be obtained from the cuts, which give an idea of the excellent mechanical construction employed in this type.

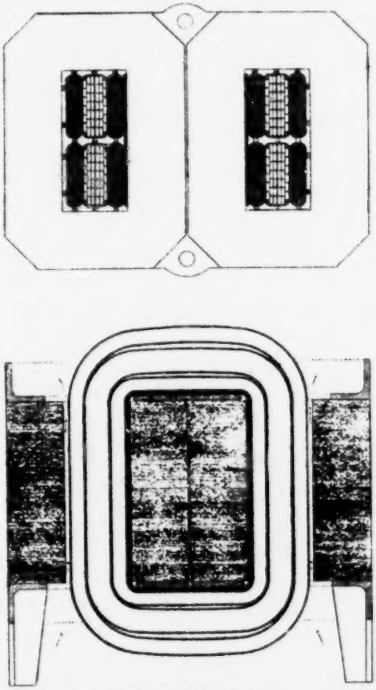


Fig. 341—Horizontal and Vertical Section Through "M" and "M H" Transformers, Without Case.

The hangers used for Type "M" transformers can be securely fastened to the back of the transformer before erection. The wide span feature allows them to be placed on the crossarm with one hanger on either side of the pole.

Oil

In the use of oil it is necessary to obtain such as is free from acid and moisture. There are many inferior grades of oil on the

179 DEFENDANT'S EXHIBIT No. 2, PLAINTIFF'S MOVING AFFIDAVITS ON PRELIMINARY INJUNCTION.

Affidavit for Use upon a Motion for Preliminary Injunction in a Suit in Equity About to be Brought in the United States Circuit Court for the Eastern District of Missouri by Westinghouse Electric & Manufacturing Company, Complainant, against Wagner Electric Manufacturing Company, Defendant.

STATE OF NEW YORK,
County of New York, ss:

Charles A. Terry, being duly sworn, deposes and says:

I am of mature age. I am a member of the New York Bar, and have been Secretary of the Westinghouse Electric & Manufacturing Company for upwards of nine years past. The Westinghouse Electric & Manufacturing Co. is the owner of U. S. letters patent No. 366,362 issued on July 12, 1887 to George Westinghouse, Jr. The General Electric Company is a license of the said Westinghouse Company under that patent.

In the year 1897 negotiations were in progress between the companies above named on the one side and the Wagner Electric Manufacturing Company on the other, looking toward a settlement of all alleged infringements by the latter concern upon the patents of the former. During these negotiations I went to St. Louis in company with the late George R. Blodgett, then representing the General Electric and Thomson-Houston companies, to meet represent-
180 atives of the said Wagner Company, particularly to explain the patents on which we relied and the nature of the infringements there complained of. During this visit, which was made about July, 1897, and in company with Mr. A. C. Fowler, counsel to the said Wagner Co. and other of its representatives, we examined many devices then being built by the said company, and found that it was contemplating infringement of Westinghouse patent No. 366,362, as well as other patents owned by the companies mentioned. Oral notice of our rights under that patent was given during said negotiations, and subsequently, very soon after our return to New York, written notice was sent by Mr. Blodgett, with my knowledge and consent, to said Wagner Co. of its infringement upon several patents, including No. 366,362.

It has been the custom of my company to mark plainly the cases of its oil cooled converters with the word "Pat." or "Patented," and the date of issue of the said Westinghouse patent, to-wit, July 12, 1887, together with the word "Westinghouse."

I am familiar with the proceedings in the suit against the Union Carbide Company on the said patent. The infringing apparatus complained of there was manufactured and sold by the Wagner Electric Manufacturing Company; and I am informed and verily believe that the last mentioned company defended said action.

I am of the opinion that a continuance of said Wagner Company

in the manufacture and sale of infringing transformers would work grievous injury to the complainant for the following reasons:

1. It would tend to encourage other manufacturers to infringe the said patent, because it is notorious that the Wagner Co., which manufactured the infringing apparatus assumed the defence of the Union Carbide case. Any escape by it from full liability for its wrongful acts would be accepted by the infringers (as I know from past experience in patent litigation) as evidence of our inability to enforce our full rights.

181 2. It would tend to encourage other users to purchase from the Wagner Co. I have caused inquiry to be made as to the conduct of the Wagner Company since the decision of the Circuit Court was rendered in the Union Carbide case, and am credibly informed that it did not cease to manufacture and sell infringing apparatus, but continued to sell and offer for sale converters which infringe the said Westinghouse patent.

3. The Westinghouse patent has but little more than two years to run, and the multiplication of infringements since the Union Carbide suit was commenced has been large. Any encouragement to infringers would add still further to their number, and to the number of suits to be brought to enforce our rights.

4. The very prominence, as well as the persistence, of the Wagner Company in infringement will give great prominence to any indulgence granted to it in respect to further infringement.

5. The large expenditure of money required to bring to a decision any action for infringement of the magnitude of this, of itself makes equitable the immediate and full enforcement of the rights so ascertained.

6. The said Wagner Company, having maintained the defence of the Union Carbide action, has had its day in Court, and the questions raised by it, of the invalidity of the said patent, of its anticipation, of its infringement, all have been decided adversely to it. To permit it to continue to infringe until the final hearing of this case would simply mean that practical relief would be denied complainant until all of these questions should be retried in an expensive and protracted litigation, for the benefit of a defendant which has already had the benefit of the delay occasioned by their trial and determination.

I have examined the certified copy of the assignment of patent No. 366,362, from Mr. Westinghouse to Westinghouse Electric & Manufacturing Company, which is attached to Mr. Thomas

182 B. Kerr's affidavit, and have compared it with the original assignment which is now in the custody of the Westinghouse Electric & Manufacturing Company. The copy is a true and correct copy. The original was prepared by me; it was signed, sealed and delivered by Mr. Westinghouse in my presence; I attested it as a subscribing witness, and I caused it to be recorded in the Patent Office in Washington. The signature of Mr. Westinghouse to the instrument I recognize as genuine. The assignment covers some twenty (20) patents. It is most desirable that the original document remain where it will be available to prove title to these patents

in actions now pending or about to be brought upon them. If the Court should desire that it be produced (according to the profert of the bill of complaint) I will be glad to submit the original document, to the Court.

The complainant and its licensee, the General Electric Co. are abundantly able and willing to supply the entire demand for apparatus containing the invention of the patent in suit.

CHARLES A. TERRY.

Subscribed and sworn to before me this 19th day of June, 1902.

[SEAL.] M. LAWSON DYER,
Notary Public (68), *N. Y. Co., N. Y.*

A true copy.

Attest:
JAMES R. GRAY, *Clerk.*

183 *Affidavit of W. J. Jenks, Taken for Use on a Motion for a Preliminary Injunction in a Suit in Equity About to Be Brought in the United States Circuit Court for the Eastern District of Missouri by Westinghouse Electric & Manufacturing Co., Complainant, against Wagner Electric Manufacturing Co., Defendant.*

STATE OF NEW YORK,
County of New York, ss:

William J. Jenks, being first duly sworn deposes and says:

I am forty-nine years old. I reside at Brooklyn, New York, and I am by profession and occupation an electrical engineer.

I testified as the principal expert for the Complainant in two suits, one brought by the Westinghouse Electric & Manufacturing Company against the Union Carbide Company and the other by the Thomson-Houston Electric Company against the same defendant, both suits being against apparatus manufactured and sold by the Wagner Electric Manufacturing Company, the first named of the suits having been brought on patent No. 366,362 granted to George Westinghouse, Jr., on July 12, 1887 and the other suit on a patent to Elihu Thomson.

A detailed statement of my experience as an electrical engineer will be found on pages 122 to 128 of the Transcript of Record in the United States Circuit Court of Appeals for the Second Circuit in the above-named cases.

I keep myself informed generally regarding the practical development of the electrical art and the apparatus made by the principal manufacturers of the United States. I have had particular occasion to investigate transformers (or converters) manufactured
184 by the Wagner Electric Manufacturing Company of St. Louis. I investigated critically apparatus made by that company in preparation and connection with my deposition in the

Union Carbide cases above referred to which involved apparatus made by the said Wagner Company and the suits were, as I have been credibly informed and verily believe, defended by the said Wagner Company.

The fourth claim only of the Westinghouse patent No. 366,362 granted on July 12, 1887 was pressed at the final hearing of the Union Carbide case, and I understand that that claim only will be under consideration on the injunction motion which is about to be brought against the Wagner Company for manufacturing and selling the apparatus used by the Union Carbide Company, and similar transformers, in infringement of the said patent. In order that the Court may clearly understand the subject-matter of the patent and in order to assist the Court in comparing the apparatus made by the Wagner Company with the invention set forth in claim 4 of the patent I will make explanation generally of the art to which the matters herein involved pertain.

The electrical apparatus here in controversy—namely, the modern static "converter," "induction coil" or "transformer" of the systems for distributing electric energy for the supply of electric lamps, motors, heating devices and other translating mechanisms—occupies a unique position among the many forms of apparatus which have been developed for the handling of the large amounts of energy required for the comprehensive application of great public utilities. The dynamo-electric generator of modern times transforms the mechanical energy of controllable motion of the steam engine, the water wheel, the gas motor or the compressed-air motor into the energy of electricity, through the intervention of magnetism. In that transformation the inevitable losses are phenomenally small. In the electric motor, which is also properly called an electro-dynamic machine, a reversed transformation takes place; from
185 electrical energy back to mechanical energy, also through the intervention of magnetism; with losses usually greater than those which accompany the process of generation of electricity. The electrical accumulator or storage battery transforms electrical energy to electrical energy through the intervention of chemical action, with losses materially greater than those of the electrical generation, and with the capability of storing somewhat indefinitely the energy which it receives; that is, being free from the limitation of the necessarily instantaneous transformation which is a feature of the generator and the motor. The converter which forms the subject matter of this discussion is unlike any of these prior mechanisms in that it transforms electrical energy to electrical energy again through the intervention of magnetism, without the ability to accumulate or store any material portion which passes through it; without any moving parts such as are essential to the dynamo and the motor; without the chemical changes and troublesome liquids and perishable chemical constituents which are essential to the storage; and with an efficiency—that is, a percentage of useful return—which rivals that of the generator itself.

These distinctive features furnish a ground-work for the successful operation of converter units of enormous size, wherever large

amounts of energy are to be handled; and in the absence of experience it might have been supposed that because the converter had no moving parts to wear out and be replaced, and no unstable chemical plates and compounds to be preserved from disintegration and frequently renewed, the building of such large converters would be a very simple matter. Practice showed, however, that these assumptions were unfounded, because another factor must inevitably enter into the calculation; namely, that percentage of the applied energy, which could never in the most perfect apparatus be recovered after tran-formation, but which must inevitably appear as heat and, if not properly and promptly dealt with, place the converter in
186 the list of those useful mechanisms which contain within themselves the elements of their own speedy destruction.

Unlike the generators and motors which also rely upon magnetism as the form of energy through which the incoming force is changed to the desired outgoing force, the static converter is able to employ a completely closed circuit of magnetic material, and for this and other reasons the converter becomes one of the most compact transforming agencies which man has ever devised. This result is also assisted by the condition that no mechanical stress—or, in other words, no moving strain—is employed; but, rather, the molecular stress, by which is effected the transmission of great forces through small masses. The small trolley wire which conducts the hundreds of horse-power of energy necessary to propel the many heavily-laden cars is a familiar illustration of the same idea.

These factors which combine to assist remarkable condensation in the size and weight of the apparatus make it all the more difficult to deal with the heat which represents the waste of energy, and it was soon found that, although the percentage of this waste might be made very small, the question of how to take care of it in relatively large units was most serious. Those skilled in the art did not anticipate this difficulty, and they were so slow to cure its effects that the consumers of the transformed energy and the insurers of the buildings in which this energy was utilized became alarmed at the liability of fires, harmful shocks and destruction of the apparatus, and forced the manufacturers to improve the features of construction of the converters, in order that the heat developed by them might be minimized and disposed of.

It is with the means devised by Mr. Westinghouse for carrying away this heat and excluding moisture from the active coils that the present discussion is concerned. It appears that the rank and file of the experimental workers skilled in the art did not success-
187 fully meet and solve the problems which the early static converters presented in this matter of the disposal of their heat-waste and the exclusion of moisture. The literature of the art contains numerous references to improvements of form and efficiency of the converters which for several years prior to 1886 were made and used. But no great step was taken in improvements of their design and protection until the originality of Mr. Westinghouse attacked the problem of enlarging the size of converters and adapting them to extreme conditions of encompassment, without in-

creasing the dangers which accompanied their use. His grasp of the subject and the skill which has prompted so many of his inventions, indicated to him that the mechanism of the converter must be modified by spreading out and dividing into sections its iron core, and thus increasing the surface from which a dissipation of the heat of the core and the coil might be carried on. With this feature he combined the application of the surface, thus increased, of some cooling, convective, insulating and moisture-excluding medium, such as gas or oil, which should be more efficient than the non-conducting air in cases where it should become necessary to provide a strong and durable encasement for the converter, and thus imprison and apply to the cooling process a certain definite quantity of heat-dissipating and insulating material. By this combination he enlarged not only the radiating surface of the converter mechanism but also the ultimate surface from which the heat should be projected and dissipated into the surrounding medium, whether the medium be air, water, the walls of a vault or the mass of the earth, underneath the surface of which he apparently understood and anticipated that this motionless transformer might be placed.

As I understand it, the conception and evolution of this oil-cooled converter greatly increases the economically available capacity of the units in which static converters might be built and operated. By such increase of size and efficiency the cost, per
188 unit of energy transformed, was greatly reduced, and the number of separate devices necessary to the accomplishment of any given work was greatly lessened. It is a matter within my knowledge that the dry transformers representing the nearest approach shown in present practice to the art prior to the date of the Westinghouse improvement, are now made having a maximum capacity in the largest sizes of 10 kilowatts, which is about 13 or 14 electrical horse-power, while the oil-insulated transformers which are made in accordance with the Westinghouse improvement are commercially serviceable up to 50 times that capacity, or 500 kilowatts, which is between 650 and 700 horse-power each.

The commercial results which have flowed from this epoch-making improvement in the art of static converters, have been enormous, and the details of this improvement, as set forth in the Westinghouse patent, constitute the subject matter of the present discussion.

The Westinghouse patent contains what is, so far as I know, the first recognition of the fact that for the use of static transformers, oil of a proper kind constitutes a far better insulator than air. By this I mean to say that so far as I am aware, no one had, prior to the date of the Westinghouse patent, called attention to the fact that where it was desirable, as in the operation of static converters, to enclose the mechanism within a case which might be reliably sealed, and where the potential was high, and the energy to be transformed was so large as to be capable of doing serious damage in case the insulation between the primary and secondary coils was broken down or a leakage was established between either of these coils and a converter case, oil of the proper kind was greatly

superior to air as an insulator. It is now known to be a fact that the resistance opposed by a stratum of such oil to the disruptive discharges which constantly tend to take place from the coils of high pressure converters to the metallic cases in which they are enclosed, is many times greater than that opposed by a
189 stratum of air of the same thickness, even when the air is dry; and especially when it is moist. Moisture was, at the date of the Westinghouse patent, recognized as the deadliest enemy of the operator of electric light and power apparatus; not only because of the fact that it constantly tended to render that apparatus unreliable, but because it assisted in setting up leakages and arcs which were usually destructive and often deadly. Mr. Westinghouse appears to have realized that he must guard his converter not only against such moisture as might leak into the spaces about and within its mechanism, but also such as might condense therein whenever it cooled after being disconnected from the circuit (as was often the case during the daylight hours), whenever the surrounding air was humid.

The method of the Westinghouse patent in suit is roughly analogous with the method of operation of a steam condenser which uses the same water over and over, cooling it by reservoir exposure to the air.

The Westinghouse patent establishes the necessity of combining the increase of the surface of the heat-producing parts (by opening up the internal passages through the core of the transformer) with increased surface of exterior radiating parts, so that these two surfaces shall bear proper relation to each other, and then connecting them for the purpose of heat dissipation, by an insulating carrier possessing high powers of heat storage and removal.

The Westinghouse patent recognized the enormous importance of high efficiency, and strove to attain it. It recognized that when the magnetic or the electric circuit, or both, became longer, as is the case when the capacity is raised without oil-cooling, the mass of the converter is greatly increased, and after passing a critical point the efficiency decreased; also that, when the temperature rises, the copper losses increase enormously, and regulation disappears. It also recognized that liquids convey away the heat much faster than air. In fact, one pound of water will do the work of four pounds of air in that respect.

190 The Westinghouse method takes the air (which may have a temperature of 40 degrees C.) as a base line from which to calculate a limited admissible temperature increase before a hazardous heat is attained.

The Westinghouse Patent, No. 366,362, opens its specification by giving a definition of the "induction coils" or "converters" or "transformers" to which its subject matter relates. It says (p. 1, lines 9-13):

"The invention relates to the construction of a class of apparatus employed for transforming alternating or intermittent electric currents of any required character into currents differing therefrom in certain characteristics."

The specification indicates, as objects to be attained in the improvement of such static converters, induction coils or transformers the following:

(*a*) simplicity;

(*b*) efficiency;

(*c*) capacity for keeping operatively cool when employed continuously for a long time;

(*d*) thorough ventilation (that is to say, free circulation, in the case of an air-cooled converter, of air; in an oil-cooled converter, of oil; in a gas-cooled converter, of gas).

In order to secure these objects the patentee proposed to construct the core of this static converter of thin plates or laminæ, such as were well known to the electric art, and to divide these plates into groups, separated from each other by air spaces; also to similarly separate the primary and secondary coils of the converter; also to encase these coils and core, and if necessary seal the case and imprison therein a non-conducting fluid or gas, impliedly other than air, so that a free circulation of this fluid or gas among the coils or groups of plates and between them and the outer case, would be secured.

The converter of this patent could not be expected to realize the above objects of improvement, that is, to maintain its efficiency or coolness, if moisture were allowed to enter to such an extent
191 as to deteriorate the insulating wrappings of the coils, or form a bridge through or under or over the fluid of gaseous insulation between the working portions of the converter and the enclosing case. Hence the oil or other insulating medium must be such as will assist in preserving the insulating wrappings or supports of the coils, and not be readily injured by heating. Thus it not only assists the sealing, in case that is practiced, but

(*a*) "preserves the insulation" even when under the strain of high potentials (p. 1, line 19);

(*b*) "excludes the moisture" (from creating leaks), and

(*c*) "cools the converter" (coils and core).

A description given by the inventor setting forth the purpose of the invention is found in lines 16 to 21. I find also a further description which is very helpful, at lines 74-82. If these two passages be considered together it appears that the prevention of overheating was only one of the objects to be attained; the exclusion of moisture and maintenance of operativeness and efficiency were others. By the broadest embodiment of the ideas of this patent the objects recited in lines 16 to 21 may be secured; by the specific and more limited embodiment of the enclosing case and insulating fluid construction, the additional objects of lines 74-82 are reached.

Claim 4 of the Westinghouse Patent refers to other flowing and insulating media—not to air or water. It states a combination of four features or elements:

(1) "an electric converter" (constructed with),

(2) "open spaces in its core,"

(3) "an inclosing-case,"

(4) "a non-conducting fluid or gas in said case adapted to circulate through said spaces and about the converter."

A typical form of transformer manufactured and sold by the Wagner Electric Manufacturing Company is described in the article which appears in the American Electrician in the issue of Jaunary 1900, which I understand is made a part of the papers in
192 this proceeding and which was taken by both sides in the Union Carbide litigation as giving a correct description of the defendant's apparatus. The specific description of the Wagner transformer commences at the bottom of page 12 of the American Electrician, a cut appearing on page 13 shows both the external appearance and the internal construction and arrangement of the Wagner transformer so far as is necessary to consider the same with reference to the Westinghouse patent. For convenience of reference I attach hereto a photolithographic copy of pages 12, 13 and 14 of the article in question. In the illustration the casing is partly broken away so as to reveal the interior of the apparatus. The reference letter A which appears at the bottom of this illustration indicates by lines extending obliquely toward the interior of the transformer, the sectionally divided coils through which the primary and secondary currents flow. The reference letter B at the top of the cut indicates a clamping device for the terminals of the secondary coils from which the transformer energy issues.

I have placed upon this copy the reference letter C which indicates "open spaces" in the core of the transformer, recited as one of the elements of claim 4 of the Westinghouse patent. This core consists of an aggregation of iron plates and serves to magnetically assist the operation of transforming the energy from the primary to the secondary coil.

I have also added the reference letter D which indicates "an enclosing case" specified in claim 4 of the Westinghouse patent. From the boiler-like construction of this case and from the emptying valve which appears at the bottom of the cut it is constructed to contain "a non-conducting fluid or gas adapted to circulate through said spaces and about the converter," which non-conducting fluid or gas forms the last element of claim 4 of the Westinghouse patent. The non-conducting fluid is in the text of the American Electrician article stated to be oil, and is repeatedly referred to on pages 12 and 13.

193 It would be practically impossible to describe the essential features of the Wagner transformers without including all the elements of claim 4 of the Westinghouse patent, indeed the elements of that claim were so noticeably and clearly present in those Wagner transformers used by the Union Carbide Company that no serious question as to the infringement of the fourth claim was, as I understand, raised in the Union Carbide litigation. I am clearly of the opinion that the Wagner transformers manufactured and sold by the Wagner Electric Manufacturing Company are infringements of the fourth claim of the Westinghouse patent, to which I have referred and I understand that this was the view of both the

Circuit Court and the Circuit Court of Appeals in the Union Carbide litigation.

I may add that this claim was sustained by the United States Circuit Court in the Western District of New York and by the United States Circuit Court of Appeals for the Second Circuit in the Union Carbide case, although its validity was most seriously contested and numerous prior patents, both domestic and foreign were recited, as anticipations and considered at length by the expert for the Defendant, and by counsel in his brief, and by both Courts in their opinions. I refer for an extended discussion of the prior art to the Transcript of Record in the former case and to the briefs filed by both parties, and to the opinions of the Circuit Court and Circuit Court of Appeals.

WILLIAM J. JENKS.

Subscribed and sworn to before me, this 17th day of June, 1902.

M. LAWSON DYER,

[SEAL.] *Notary Public* (68), *N. Y. Co., N. Y.*

(A true copy.)
Attest:
JAMES R. GRAY, *Clerk.*

194 Affidavit for use upon a Motion for Preliminary Injunction in a Suit in Equity About to be Brought in the United States Circuit Court for the Eastern District of Missouri by Westinghouse Electric & Manufacturing Company, Complainant, against Wagner Electric Manufacturing Company, Defendant.

STATE OF NEW YORK,
County of Schenectady:

Benjamin B. Hull, being duly sworn, deposes and says:

I am of mature age, reside at Schenectady, New York, and am employed by the General Electric Company of that place as Managing Clerk of its Patent Department and have been thus employed for more than the seven years last past. Under the general supervision of Mr. Albert G. Davis, since December 1897 the head of the Patent Department, I am in direct charge of the files and records of the department and am generally familiar with the entire correspondence carried on by the department.

In the department files, I find a copy of a letter written on April 28, 1897, by Mr. George R. Blodgett, the then head of the Patent Department to Mr. Herbert Wagner of St. Louis, Mo., calling his attention to the infringement by the Wagner Electric Manufacturing Company of a large number of patents owned or controlled by the General Electric Company. A copy of this letter is hereto attached and marked "Exhibit A." Under date of May 13, 1897, the Wagner Electric Manufacturing Company, per Herbert A. Wagner, Gen. Mgr., acknowledged receipt of Mr. Blodgett's letter, and a copy of this letter of May 13th, is hereto attached and marked "Exhibit B."

195 On July 13, 1897, Mr. Blodgett addressed a letter to A. C. Fowler, Esq., of St. Louis, Mo., in which he listed certain patents which were considered to be infringed by the Wagner Electric Manufacturing Company. A copy of this letter is attached and marked "Exhibit C". Exhibits A and C are copies of Carbon copies of the original letters, which carbon copies have been in the files of the Patent Department ever since they were written, as indicated by the dates thereon. Exhibit B is a copy of the original letter written to the General Electric Company by the Wagner Electric Manufacturing Company in the files of the Patent Department.

And further deponent saith not.

BENJAMIN B. HULL.

Subscribed and sworn to before me this 19th day of June, 1902.

EDWARD WILLIAMS, Jr.,
Notary Public, Schenectady County, N. Y.

A true copy.
Attest:
[SEAL.] JAMES R. GRAY, *Clerk.*

196 EXHIBIT A.

APRIL 28, 1897.

Mr. Herbert Wagner, Esq., St. Louis, Mo.

DEAR SIR: We find that the alternating motors and transformers which the Wagner Electric Manufacturing Company is making infringe quite a large number of patents which are owned or controlled by the General Electric Company, or under which it is licensed, and feel that this is an important matter which should receive prompt attention.

At the suggestion of some of our officers I write to ask if you are to be in the east within the next week or ten days or can come on to discuss the matter with Mr. Terry and myself.

While we shall be obliged to defend our patents from infringement we desire to extend all possible courtesy and free the litigation from all unnecessary annoyance. Hence I have thought it worth while to suggest such a meeting in which we can exchange views before taking steps to actually bring suit. If you will meet us in New York City, kindly name a day at your earliest convenience.

Yours very truly,

——— ———.

197 EXHIBIT B.

Wagner Electric Manufacturing Co.

General Offices & Factory, 2017-2023 Locust Street.

No. 113.

Address all Communications to the Company.

ST. LOUIS, MO., *May 13th*, 1897.

General Electric Co., Geo. R. Blodgett, Counsel, Schenectady, N. Y.

DEAR SIR: Your letter of the 28th ult. was duly received, but the writer has not found time to answer until now.

The statement which you make in regard to infringement is quite a surprise, as if such is a fact, it is not in accordance with information which we have been able to obtain. It is not our policy to knowingly infringe any one's patents.

The writer expects to be east about the middle of next month and will be pleased to see you and Mr. Terry to thoroughly discuss this matter. If, however, you could find it possible to let us know in the meantime just which patents of yours we infringe we could probably have the matter better in hand for discussion when we meet.

Awaiting your reply, we are,

Yours very truly,

WAGNER ELECTRIC MFG. CO.,
HERBERT A. WAGNER, *Gen. Mgr.*

198 EXHIBIT C.

JULY 13TH, 1897.

A. C. Fowler, Esq., St. Louis, Mo.

DEAR SIR: In accordance with your request I hand you herein a list of patents which we believe are infringed by the apparatus made by the Wagner Electric Manufacturing Company. The list has been rather hurriedly compiled, but it comprises all the principal patents which I now have in mind.

Edison, 264,668, Sep. 19, 1882.
McTighe, 295,789, Mar. 25, 1884.
Eickemeyer, 351,906, Nov. 2, 1886.
Eickemeyer, 377,996, Feb. 14, 1888.
Knight, 389,658, Sep. 18, 1888.
Thomson, 400,971, Apr. 9, 1889.
Thomson, 407,844, July 30, 1889.
Thomson, 415,749, Nov. 26, 1889.
Thomson, 428,648, May 27, 1890.
Thomson, 430,328, June 17, 1890.
Thomson, 478,722, July 12, 1892.
Ekstrom, 508,688, Nov. 14, 1893.
Thomson, 516,849, Mar. 20, 1894.
Thomson, 544,396, Aug. 13, 1895.
Thomson, 545,554, Sep. 3, 1895.
Van Depoele, 390,921, Oct. 9, 1888.
Stanley, 349,617, Sep. 21, 1886.
Westinghouse, 366,362, July 12, 1887.
Shallenberger, 373,029, Nov. 8, 1887.
Belfield, 386,796, July 31, 1888.
Belfield, 386,797, July 31, 1888.
Kennedy, 11,031, Sep. 24, 1889, (Reissue)
Stanley, 469,809, May 1, 1892.
Bradley, 390,439, Oct. 2, 1888.
Bell, 516,797, Mar. 20, 1894.
Thomson, 360,125, Mar. 29, 1887.

Yours very truly,

(Signed) GEO. R. BLODGETT.

199 Affidavit for Use upon a Motion for Preliminary Injunction in a Suit in Equity About to be Brought in the United States Circuit Court for the Eastern District of Missouri by Westinghouse Electric & Manufacturing Company, Complainant, against Wagner Electric Manufacturing Company, Defendant.

STATE OF NEW YORK,
County of Jefferson, ss:

Thomas B. Kerr, being duly sworn, deposes and says:

I am of mature age and have been a practicing attorney and counsellor at law for upwards of thirty years. I am a member of the firm of Kerr, Page & Cooper at 120 Broadway. My firm is counsel to the Westinghouse Electric & Manufacturing Company, and I have had personal charge, on its behalf, of certain litigation upon U. S. letters patent No. 366,362, July 12, 1887, issued to George Westinghouse, Jr., and subsequently assigned to the said Company.

The history of that litigation is, briefly, as follows:

About May 1900, being informed that the Union Carbide Company, a West Virginia corporation having an electric power plant at Niagara Falls, New York, had bought and was using several oil-cooled transformers or converters not manufactured by the complainant or its licensee, and containing the invention set forth in the Westinghouse patent just referred to, I caused suit to be brought against that Company. At the time the action was commenced Niagara Falls was within the Northern Judicial District of New York. Soon after May 10th, when the bill was filed, the
200 Western Judicial District of New York was organized, and as Niagara Falls is included within that District the case was transferred to the new Western District, where it proceeded after the ordinary course of equity actions for the infringements of patents. The facts upon which the suit was based were admitted, and the case ultimately came on for final hearing before his Honor Judge Hazel about May 24th 1901. Judge Hazel filed an opinion in favor of the complainant on November 11th 1901. Thereafter the defendant appealed to the Court of Appeals for the Second Circuit. The argument of the case on appeal was had before that Court on February 27th and 28th, 1902, and on May 29th 1902 the Court of Appeals filed its opinion written by Judge Townsend, affirming the decree of the Circuit Court.

At the same time that this suit was pending, another action was brought by the Thomson-Houston Company against the same defendant involving the patent to Elihu Thomson. For convenience of counsel in the preparation and presentation of the cases, the Thomson-Houston case and the Westinghouse case were argued together as a single cause, both before the Circuit Court and the Circuit Court of Appeals. The Thomson-Houston case was decided by the latter Court in favor of the defendant. I make this explanation because some of the papers to which I shall immediately refer concern the Thomson-Houston case as well as the Westinghouse case, but no further attention need be paid to the matters and things pertaining to the Thomson-Houston case.

In order that the Court may understand thoroughly the issues of this litigation on the Westinghouse patent, I offer as an exhibit to be used in connection with this affidavit, a copy of the official transcript of record printed under the direction of the Clerk of the U. S. Court of Appeals for the Second Circuit, which contains the entire record in both of the Union Carbide cases, including the pleadings, testimony and exhibits on behalf of both parties,
201 a copy of the opinion of Judge Hazel and of the appeal papers on the appeal to the Circuit Court of Appeal. This I mark "Exhibit 1."

It appeared in an article descriptive of the defendant's infringing devices in the Union Carbide case, that they had been manufactured by the Wagner Electric Manufacturing Company (Exhibit 1, p. 216, bottom). This article was stipulated to be a correct description of the infringing devices (Exhibit 1, p. 14, fol. 59). I always have understood that the Wagner Electric Manufacturing Company defendant the suit on behalf of the user, and I know that Mr. A. C. Fowler, who argued the cases in both courts, is counsel for the Wagner Company. In the briefs which he submitted on behalf of the defendant, he admitted that the said Wagner Company manufactured the articles in controversy, and that fact was specifically found by Judge Hazel (Exhibit 1, page 557, bottom).

I have kept myself informed in a general way of the doings of the said Wagner Company, and I have been credibly informed and believe that it has manufactured and sold many infringing transformers or converters besides those involved in the Union Carbide suit. I believe that if it were allowed to continue the manufacture, use and sale of such infringing apparatus great injury would be done to the complainant, for the patent in suit has but a short time to run, viz., until July 12, 1904; it has been sustained after an arduous and costly litigation which was defended by the very manufacturer against which this suit is about to be brought. Moreover, if the said Wagner Company be permitted to go on after an adjudication against its devices, other manufacturers will be encouraged to infringe by reason of the inability of the Westinghouse Company to stop this infringer, even after this long continued effort.

I offer as exhibits to be used in connection with this affidavit, a certified copy of the letters patent in suit, a certified copy of the assignment thereof to the complainant, and a copy of that part of the opinion of the Circuit Court of Appeals for the Second Circuit which deals with the patent No. 366,362 which is to be in-
202 volved in this suit; also a certified copy of each of the charters of the complainant and defendant companies. I mark these exhibits in the order in which they are named, respectively, "Complainant's Exhibits Nos. 2, 3, 4, 5 and 6".

I also attach and mark "Complainant's Exhibit No. 7", a copy of an Affidavit of W. A. Layman, Assistant General Manager of the Wagner Electric Manufacturing Company, verified December 6th, 1901. This affidavit was taken for use on a motion made by the defendant in the Union Carbide case to suspend, pending appeal, to the Circuit Court of Appeals for the Second Circuit, the injunction decreed by the Circuit Court. It avers as a positive fact that

the said Wagner Co. manufactured and sold to the Carbide Co. the apparatus which was found to infringe the patent in suit. The descriptive article of defendant's apparatus to which I have referred above, is found at pages 12 and 13 of the issue of the American Electrician, for January 1900, (Vol. XII, No. 1). The American Electrician is a monthly journal published at New York City. I attach a copy of said publication hereto, and mark it "Complainant's Exhibit No. 8". THOMAS B. KERR.

Subscribed and sworn to before me this 18th day of June, 1902.
GEORGE E. GRENELL,
[SEAL.] *Notary Public.*

STATE OF NEW YORK,
County of Jefferson, ss:

I, E. A. Chapman, Clerk of the County of Jefferson and Clerk of the Supreme and County Courts, which are Courts of Record in and for said County do hereby certify: That George E. Grenell, Esq., whose name is subscribed to the certificate of proof or acknowledgment of the annexed instrument and thereon written, was, at the time of taking such proof or acknowledgment a Notary Public in and for said County, residing in the said County, duly authorized to take the same; that I am well acquainted with the hand-
203 writing of said Notary Public and verily believe that the signature to said certificate of proof or acknowledgment is genuine; and that said instrument is executed and acknowledged according to the Laws of the State.

In Testimony Whereof, I have hereunto subscribed my name and affixed the seal of the said County and Courts thereof, at Watertown, N. Y., this 19th day of June, 1902.
[SEAL.] E. A. CHAPMAN, *Clerk.*
By —— ——, *Deputy Clerk.*

A true copy.
Attest:
JAMES R. GRAY, *Clerk.*

UNITED STATES OF AMERICA,
Eastern Division of the Eastern Judicial District of Missouri, ss:

I, James R. Gray, Clerk of the Circuit Court of the United States, in and for the Eastern Division of the Eastern Judicial District of Missouri, do hereby certify the writing hereto attached to be a true copy of Bill of complaint, moving affidavits and order to show cause. In Case No. 4457 of Westinghouse Electric and Manufacturing Co. Plaintiff, against Wagner Electric Manufacturing Co. Defendant, as fully as the same remain on file and of record in said case in my office.

In Witness Whereof, I hereunto subscribe my name and affix the seal of said Court at office in the City of St. Louis, in the Eastern Division of said District, this 24th day of June in the year of our Lord, nineteen hundred and two. JAMES R. GRAY,
[SEAL.] *Clerk of said Court.*
By —— ——, *Clerk.*

204 EXHIBIT No. 7.

United States Circuit Court, Western District of New York.

In Equity. No. 6853.

THOMSON-HOUSTON ELECTRIC COMPANY
vs.
UNION CARBIDE COMPANY.

In Equity. No. 6854.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY
vs.
UNION CARBIDE COMPANY.

Affidavit of W. A. Layman.

STATE OF MISSOURI,
City of St. Louis, ss:

W. A. Layman, being first duly sworn according to law, deposes and says:

My name is Waldo A. Layman. I am Assistant General Manager of the Wagner Electric Manufacturing Company, of St. Louis, Missouri, and am familiar with the Company's business. In June of 1899, nearly one year before these suits were brought, we furnished the Union Carbide Company, the Defendant in the above entitled cases, the seven transformers complained of in the above entitled suits. I am familiar with the plant of the Union Carbide
205 & 206 Company. These transformers comprise by far the greatest part of the Union Carbide Company's electrical plant, and if the Union Carbide Company, be enjoined by injunctions in these cases, from the use of these transformers, it will practically suspend their business. The Union Carbide Company is not a manufacturer of transformers. The Wagner Electric Manufacturing Company has been manufacturing transformers like the above mentioned transformers for four or five years, and more that three years prior to the bringing of these suits. All of the above mentioned transformers were constructed with open spaces in the core, and were immersed in oil, and had a coil of pipe in the oil, through which coil cold water is circulated.

Such transformers are also manufactured and sold, and have been for many years, by various manufacturers throughout the United States, and are still being so made and sold by such manufacturers.

W. A. LAYMAN.

Sworn to and subscribed before me this 6th day of December, 1901.

My term expires April 8, 1904.

JAMES H. BRYSON,
[NOTARIAL SEAL.] *Notary Public, St. Louis, Missouri.*

A true copy.
Attest:
JAMES R. GRAY, *Clerk.*

Defendant's Exhibit No. 3, Catalogue No. 102, Wagner Electric Manufacturing Company, Bulletin No. 43, dated 1901.

WAGNER ELECTRIC MFG. CO.

ST. LOUIS, U. S. A.

Catalogue No. 102
Bulletin No. W-43 (Replacing Nos. 9, 10 and 16) 1901

TYPE "M" TRANSFORMERS

We continue to advocate the shell construction for transformers, for the reason that this form is not only the most efficient from a theoretical standpoint—all other conditions of insulation, material and temperature remaining the same—but practical demonstration confirms the theoretical conclusions. The regulation of shell type

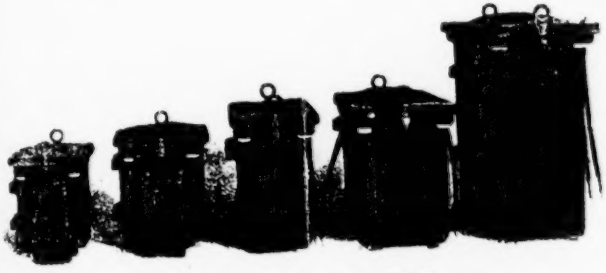


Fig. 226—Standard Type "M" Transformers

transformers on both non-inductive and inductive loads is far superior to the best regulation that can be obtained with transformers of the core type. The relative positions of core and coils in the core type suggests considerable magnetic leakage on inductive loads, and on three-wire distribution, with unbalanced loads on the two sides of the secondary.

In the shell type of transformer, the coils are so spaced as to give free circulation of oil, not only about the coils, but also between the coils and the iron. This circulation is practically impossible in the core type. The temperature of every part of the transformer of shell form of construction is therefore lower, because the circulation



Fig. 227—Front View—15 K. W. Type "M" Transformer
Four Primary and Four Secondary Leads
1100-2200 to 110-220 Volts

obtained brings cool oil in contact with not only the primary windings, but with the secondary coils and the iron as well. Thus, by keeping the temperature at a very low point, the insulation of every part of the transformer is preserved. There is also the additional advantage of preventing appreciable ageing of the iron, by keeping its temperature very low.

Central station men are beginning to realize the superiority of shell type transformers, and during the past year many core transformers have been replaced by the shell type.

Our Type "M" transformers possess the following superior features:

1st—High insulation between coils and between coils and iron.

2d—High layer and turn insulation.

3d—Low core loss.

4th—Freedom from ageing.

5th—Low temperature rise.

6th—High efficiency.

7th—Superior regulation on two and three-wire systems and on non-inductive and inductive loads.

Wagner Type "M" transformers are superior to any line of transformers on the market at the present time, and we are prepared to verify this claim in a most conclusive manner.

Insulation Tests

In order to insure long life and absolute protection against break-down between coils, or between core and coils, all Type "M" transformers are subjected to the following insulation tests:

12,000 volts without oil between primary and secondary.

10,000 volts without oil between primary and iron.

10,000 volts without oil between secondary and iron.

Besides the above tests, every transformer is subjected in the factory to a turn and layer insulation test, at high frequency, of *three and one-half times normal voltage for ten minutes.*

These tests prevent a transformer with defective insulation leaving the factory, or break-down by lightning when a reasonable degree of protection is afforded by means of approved lightning arresters.

The insulation between coils, and between coils and iron, consists very largely of non-combustible material, thus insuring good insulation between coils, even after the transformer has been injured by excessive overload, lightning, or other cause.

The easiest form of surface to insulate properly is a flat one, and we therefore build our transformers with a flat boundary surface between primary and secondary coils.

The impedance of these transformers is very low, and to prevent any possibility of excessive overload during the test of turn and layer insulation, a 133-cycle current is used.

Regulation

This low impedance of our standard transformers is an important factor in their good regulation on both inductive and non-inductive loads, and on two and three-wire systems of secondary distribution.

Regulation on inductive loads is becoming more important as the number of plants operating with a mixed lamp and motor load is constantly increasing. Many makes of transformer, while giving fair regulation on non-inductive loads, give extremely poor regulation on inductive loads.



Fig. 228—Rear View—15 K.W. Type "M" Transformer
Four Primary and Four Secondary Leads
1100-2200 to 110-220 Volts

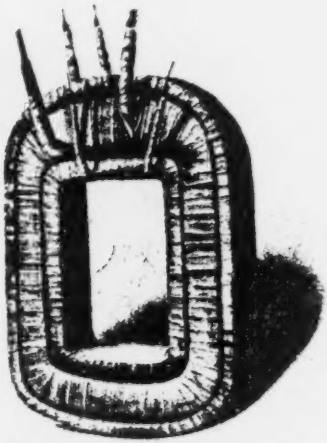


Fig. 229—One-half Set of Assembled Coils, for 10 K. W. Type "M" Transformer

Another factor in the regulation of transformers is the operation on three-wire secondary, with the load on the two sides of the circuit unbalanced. The regulation of Type "M" transformers is practically the same on three-wire as on two-wire distribution, and is not affected by an unequal distribution of the secondary load. In fact, Type "M" transformers will be found to excel in regulation, both on inductive and non-inductive loads, and on two and three-wire distribution.

Temperature

All Type "M" low frequency transformers are designed for a maximum rise in temperature of 50 degrees C. when operated continuously at full load. This increase of temperature is measured by increase in resistance of copper coils. When used on ordinary lighting load they will operate at a temperature very much below the above specified value. Two sets of temperature curves are illustrated on page 12, one showing the rise in temperature, with full load losses, starting cold, and the other showing the rise in temperature, with full load losses, after reaching the maximum temperature due to core loss. These two sets of curves illustrate very clearly the relative values of the two methods. The second method of testing conforms to the actual conditions in a large number of plants where the transformers are in circuit twenty-four hours of the day, and never drop to a lower temperature than the maximum due to core loss. This temperature may therefore be considered the minimum service temperature.

The cross section of a 15 K. W. transformer, on page 10, illustrates very clearly the excellent provision that has been made for cooling *primary* and *secondary* coils, and *iron*, by keeping up a natural circulation of oil. This is one of the most important advantages of the shell type transformer. These oil ducts are so proportioned and so placed that, while they keep all parts of the transformer cool, and

thus prevent deterioration of insulation and reduce ageing of iron to a minimum, they cause a minimum loss in efficiency.

The advantages of low temperature in all parts of a transformer cannot be over-estimated. It is of comparatively little use to have the primaries run cool, if the secondaries and core are hot, for the secondary as well as the primary insulation should be kept from the slow oxidation which invariably takes place at a high temperature; and if the core is allowed to run hot, ageing of the iron or steel of which it is composed is certain to take place, no matter what its quality.

In the *shell* type transformer the iron is the coolest part, while in the *core* type it is the *hottest*. Therefore, in the use of shell transformers, the temperature of the coils can be taken as the highest temperature of the transformer, while in the core type of transformer the iron or steel is even hotter than the hottest part measured by the resistance method.

In a recent test on a core transformer of prominent make, the secondary was found to be over *forty per cent hotter* than the primary.

Core Loss

The next point of importance in a transformer is economy of operation, which depends not only on the total losses, but more particularly upon the core loss. Of two transformers with identical total losses, that one showing the lower core loss is to be preferred, because of the greater all-day efficiency obtained, and the resulting increase in economy of operation.

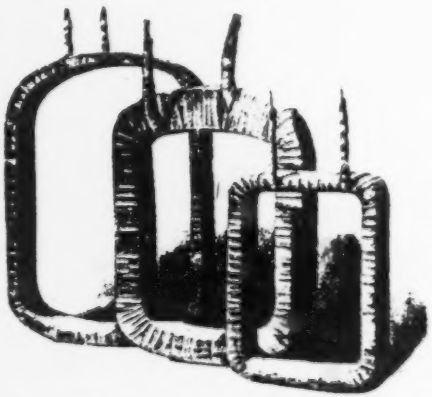


Fig. 230—One-half Set of Coils, Separated, for 10 K. W. Type "M" Transformer

In this also the shell type of transformer has a distinct advantage over the core type, for, all other conditions being equal, the shell type will have the smaller core loss.

The importance to the economical operation of a central station, of testing for core loss every transformer received, cannot be over-

estimated. The variation in core loss of two transformers of identical design may be considerable, depending, as it does, not only upon the constituents of the steel used, but also upon the method of treatment.

Ageing of Iron

Much has been said in the past, and is still being said, about the ageing of iron. The steel used in the construction of the cores of our

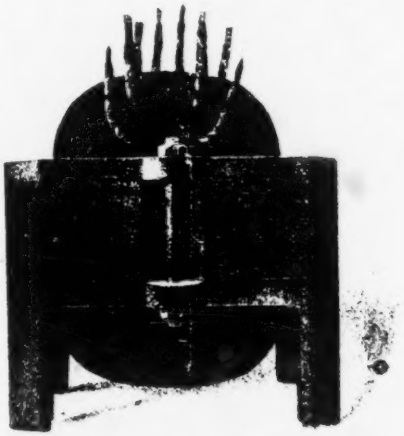


Fig. 231—Side View—5 K. W. Type "M" Transformer, Without Case

transformers is given a special treatment in our furnaces, which practically prevents ageing, even at comparatively high temperatures, and the excellent provision in our transformers for keeping the core cool is a still further preventive of ageing.

Transformers built by this Company with this specially treated steel, operated continuously on full load for over three years, show no material increase in core losses. Experiment shows that iron or steel under high temperature is certain to undergo considerable ageing. Even iron or steel which shows no material ageing at low temperatures ages considerably at high temperature. If you wish to prevent ageing of iron, keep the core cool. This can be done properly in shell type transformers only.

Copper Loss

This is a point which does not always receive its full share of attention from station superintendents. While it is not necessary to

measure the copper loss on every transformer received, it should be measured on one or two of each size received in any given shipment. That these losses may be far in excess of guarantees is shown by the fact that a two-kilowatt transformer of a prominent make, recently tested, showed a copper loss of 62 watts, with a guarantee of only 50 watts, or a loss 25 per cent in excess of guarantee.

Testing

We invite our customers, and offer to them facilities for the purpose of testing our transformers for losses, temperature, insulation, etc., feeling sure that such tests will sustain every claim we make.

Insulation

The smaller sizes of transformers have sufficient radiating surface to liberate the heat produced, without the use of oil or other means of cooling, and this has made possible a special treatment of the trans-

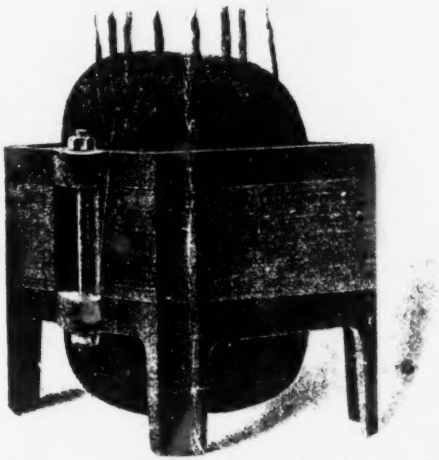


Fig. 232—Perspective View—5 K. W. Type "M" Transformer, Without Case

former after practical completion, which makes it virtually indestructible. These are so treated that the core and coils form, with the case, a single compact mass of material, unaffected by moisture. All space usually filled with oil in the oil-filled transformers is completely filled with a special compound of extremely high insulating qualities. Transformers with this construction have been tested to over 30,000 volts between coils without breaking down.

The 600, 1,000 and 1,500-watt transformers are treated in this manner. The advantage of this form of construction cannot be overestimated. Absolutely no vibration can take place, as each wire is permanently imbedded in insulating compound. In the larger transformers the windings are correspondingly treated, accomplishing practically the same general results, but, owing to the fact that the radiating surface of the transformer is not sufficient to liberate the heat produced without rise in temperature exceeding the conserva-



Fig. 233—Side View—3 K. W. Type "M" Transformer, Without Case

tive limit of the best practice, we recommend the use of oil, the circulation of which carries the heat from the coils and core, thus keeping the temperature of the transformers within the limits for which they are designed.

Special attention is called to illustrations showing our superior method of insulating the primary and secondary coils. Each coil is wound in an insulating cell, and the coils assembled. By this construction we are enabled to insulate the primary and secondary coils more completely than can be done in any other type of transformer. The insulation employed is essentially fire-proof, so that perfect insulation between coils, and between coils and iron, is, at all times and under all conditions, assured. Too much emphasis cannot be placed on the proper insulation of transformers.

Mechanical Details

The general appearance of the mounted transformer can be obtained from the cuts, which give an idea of the excellent mechanical features of the construction employed in this type.

The hangers used for Type "M" transformers can be securely fastened to the back of the transformer before erection. The wide span feature allows them to be placed on the crossarm with one hanger on either side of the pole.

Oil

In the use of oil it is necessary to obtain such as is free from acid and moisture. There are many inferior grades of oil on the market, and in order to provide against the use of these, our guarantees against burn-out hold only when the oil used is furnished by us. No oil is shipped from the factory without having been treated by a special process, and subjected to the proper insulation tests, to insure its good insulating qualities.

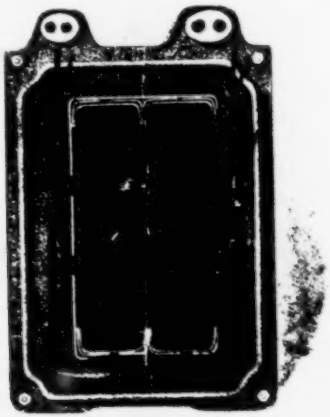


Fig. 234—End View—3 K. W. Type "M" Transformer, Without Case

Voltage

Standard stock Type "M" transformers are built for 1,100 or 2,200 volts primary, and 110 or 220 volts secondary. These voltages have been adopted as being nearer to the line voltages in general use at the present time than other voltages heretofore employed by transformer manufacturers. Thus these transformers are suitable for operation on circuits with line voltage from 1,000 to 1,200, or 2,000 to 2,400, the all-day efficiency being better at 1,000 and 2,000 volts, while the regulation is best at 1,200 and 2,400 volts. Other ratios can be furnished on comparatively short notice; however, see table, page 13. Our Type "M" transformers are designed to have a lower core loss at 1,100 and 2,200 volts than any other standard line of trans-

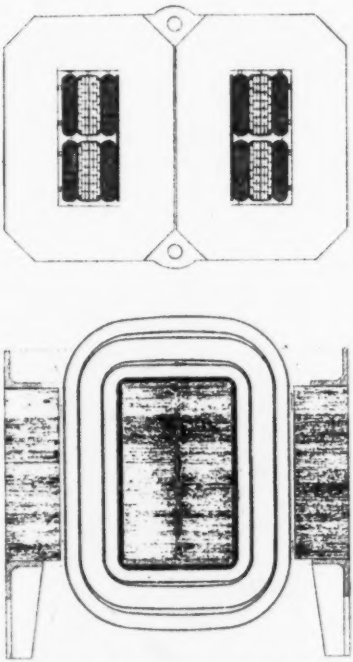


Fig. 235—Horizontal and Vertical Section Through 10 K. W. Type "M" Transformer, Without Case

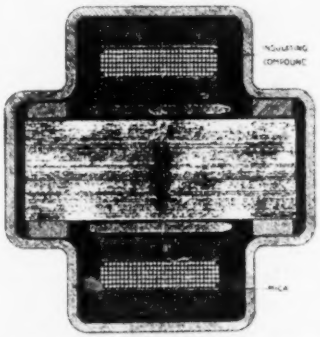


Fig. 236—Horizontal Section Through 1 K. W. Type "M" Transformer Showing Insulating Compound



Fig. 237—Hangers for Type "M" Transformers



Fig. 238—Back View—5 K. W. Type "M" Transformer
Two Primary and Four Secondary Leads
1100-2200 to 110-220 Volts

formers. At present more central stations are operating with voltages approximating 1,150 or 2,300 volts, than with any other. For plants operating at this high line voltage, namely, 1,150 to 1,300 volts, or 2,300 to 2,600 volts, we are prepared to furnish another standard line, designated as our Type "M" 1,200 or 2,400 to 120 or 240-volt line, with practically the same losses at 1,200 and 2,400 volts as are obtained in our present line at 1,100 and 2,200 volts. Customers will therefore have a choice between two standard lines equally good

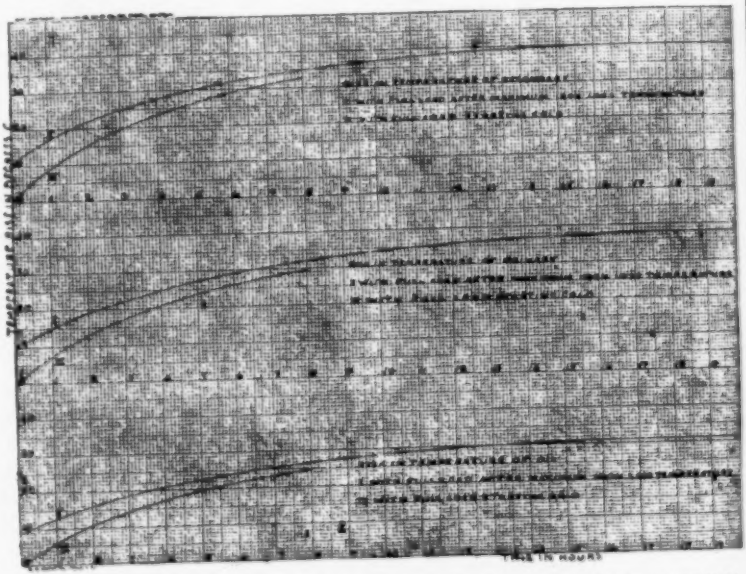


Fig. 239—Temperature Curves of 5 K. W. Type "M" Transformer 1100-2200 to 110-220 Volts

in construction and losses, and can select either transformers with very low core loss and correspondingly high all-day efficiency and with good regulation, or transformers with somewhat greater core loss and exceedingly close regulation.

Lead Wires

Transformers are built with four secondary leads, and can be furnished with two primary leads and an interchanging device in primary circuits of transformer, or with four primary leads.

219 DEFENDANT'S EXHIBIT No. 4, COPY JUDGE AMIDON'S DECISION.

United States Circuit and District Courts.

No. —.

WESTINGHOUSE ELECTRIC & MFG. CO., Complainant,
vs.
WAGNER ELECTRIC MANUFACTURING CO., Defendant.

Oral Opinion by Judge Amidon.

The points to be heard are upon an order which was granted, requiring the defendant company to show cause why it should not be punished for contempt for violating a preliminary injunction, granted in this cause in June, 1902, and also why a preliminary injunction should not be issued specifically restraining it from the further manufacture or sale of the device complained of in the moving papers.

The facts, briefly, upon which the application to punish the defendant for contempt is based, are these: A suit was instituted in 1900 in the Circuit Court of New York, wherein the present complainant was plaintiff and the Union Carbide Company was defendant. The object of that suit was to restrain the defendant there from using a device which was an exact copy in all material features of the device covered by the complainant's patent. The issue which was tried in that cause was the validity of the complainant's patent. It was admitted that, if the patent was valid, the defendant was guilty of infringing. The device which was used by the
220 Carbide Company was purchased by it of the defendant in the present cause. In that suit, the validity of the patent was sustained, both by the Circuit Court and in the Circuit Court of Appeals in the Second Circuit. The decision in the Circuit Court of Appeals was rendered in May, 1902. Thereafter, in June of that year, the present suit was instituted in the Circuit Court of this district, asking an injunction to restrain the defendant from the further manufacture or sale of the infringing device.

It has been made to appear to my satisfaction in this suit, that counsel for the defendant, as well as the officers of the defendant, understood that that was the full scope of the relief that was sought on the application for the preliminary injunction, namely, a restraint of the further manufacture of the device which was involved in the suit in New York. Counsel for the defendant appeared in court in the present suit and consented to the granting of the injunction, which was issued in June, 1902. It appears from the evidence in the present case upon this hearing, that the defendant, the Wagner Electric Manufacturing Company, had been engaged for some five years in the manufacture of the device which is now complained of. It further appears that the defendant, in order to obviate the infringement which was established in the suit in New York, transformed all its converters which had been manufactured in conformity with the device there in evidence to the form of the

device now complained of. It has gone forward in the manufacture and sale of these devices. In so doing, I am satisfied that it has acted in the utmost good faith and under the advice of counsel. I am the more inclined to accept as entirely true the representations of the defendant in this regard, from the fact that the defendant had been engaged for some five years in the manufacture of the same device, had advertised it extensively to the trade, and had sold it throughout the country without any complaint on the part of the complainant. It is quite manifest that no showing has been
221 made here which would justify the punishment of the defendant for contempt for a violation of the preliminary injunction.

The other question that is presented in this cause is, whether a preliminary injunction shall be granted to specifically restrain the defendant from further manufacture or sale of the device now complained of.

It is charged that this device violates the fourth claim of the complainant's patent. That claim reads as follows:

"The combination, substantially as described, of an electric converter, constructed with open spaces in its core, an inclosing case, and a non-conducting fluid or gas in such case, adapted to circulate through said spaces and about the converter."

The defendant's device has no open spaces in its core; the cooling liquid does not circulate through any such spaces. On the contrary, the defendant has sacrificed efficiency, in its device, and placed the spaces between the core and the coils through which the cooling liquid is supposed to circulate. It is manifest from a consideration of the specifications of the Westinghouse patent that the open spaces in the core *is* a prominent and distinctive feature of that patent. And that the defendant's device does not contain that element. So, if the patent is to be read, and the device compared, there is no literal infringement.

The only question is, whether the device which has been adopted by the defendant, is the mechanical equivalent of the device embraced in the complainant's patent. To determine that question would necessitate a very careful and full investigation of the prior art. I do not think such an investigation can properly be made upon a preliminary hearing, or upon the showing that has been made upon the present case. Such an investigation is only proper for the final hearing. I am confirmed in this opinion, by the opinion which has been handed down by Judge Kirkpatrick of the
222 District of New Jersey, in a suit brought by the present complainant against a defendant for the manufacture and sale of a device which certainly comes quite as closely within the terms of the complainant's patent as does the device of the defendant here.

An order will therefore be entered, denying the application to punish the defendant for contempt, and denying the application for a preliminary injunction. The order may be prepared by counsel for defendant and submitted to me.

Thos. B. Kerr and Drury W. Cooper, for the plaintiff.
A. C. Fowler for defendant.

Defendant's Exhibit No. 23, Wagner Bulletin No. 9.

Wagner Electric Manufacturing Company

ST. LOUIS, U. S. A.

Catalogue No. 101.
Bulletin No. 9.

December, 1897.

Type G Transformers.

The latest and best transformer—such is the announcement this company desires to make to the trade. It is with a pardonable degree of pride that the new line is finally placed upon the market, for in it is embodied the highest development from every point of view of the science and art of transformer building. This is not simply a manufacturer's claim based upon a theoretical design as yet unsupported by practical tests, but a fact demonstrated to the complete satisfaction of this company by actual results upon a sufficient number of transformers to leave no room for question as to its accuracy. The last year has developed a much keener appreciation upon the part of central station men of the vital part played by the transformer in economical central station distribution, and there has gradually appeared a demand for an increased operating efficiency in transformers. Such a

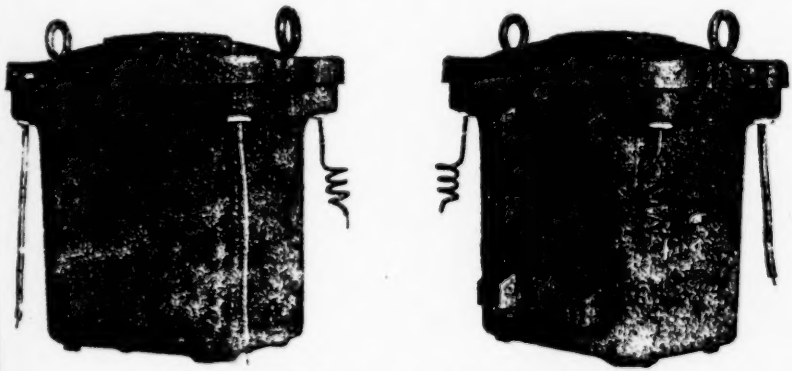


Fig. 38. Ten K. W. Type G without Fuse Cut-outs.

tendency this company has constantly endeavored to stimulate, believing that the greatest success in transformer manufacture was to be achieved not alone by building the best product in the market, but by persistently improving even a superior line of apparatus. With the Type D Transformer, which has stood without a competitor for several years, this company has achieved an enviable success. Test after test in competition with the transformers of any and all other manufacturers has accorded the Type D supremacy, and at this time, were the policy of this company simply to maintain its position at the head of the list of transformer builders, a line better than the Type D would not be necessary. Such, however, has not been our line of action. From the first day of its entrance into the field of transformer building, the company has constantly carried on extensive experiments with

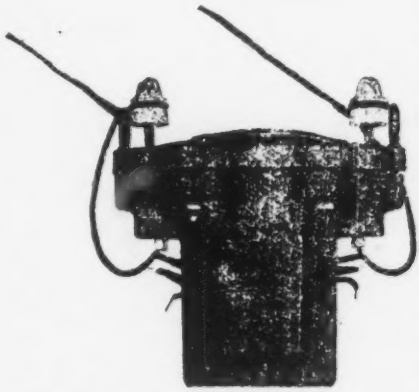


Fig. 39. One-half to Five K. W. Type G with attached Cut-outs.

no other end in view than the development of its apparatus as rapidly as the conditions of the general trade demanded it. The Type D line marked a material advance over the Type C. In the same manner the Type G now excels the Type D.

DECREASE OF INTERNAL LOSSES.

The end in view in the design of the Type G line was, primarily, a general decrease in the internal losses of the transformer. Most desirable of all was a decrease in the **"core loss."** This is the loss which goes on without interruption day in and day out, whether the customer uses power or not. Increasing importance is daily attaching itself to this element of transformer loss, from the fact that the list of stations furnishing an all-day service is constantly growing. The station man who has not been particularly concerned heretofore about his transformer leakage losses, because they did not "amount to much" for the few hours of the evening when his plant was running, now takes a different view of the matter. Of late he has had on an all-day service, having secured a good alternating current motor load, and he sees the necessity of cutting down core losses.

ALL DAY EFFICIENCY.

In other words, we have aimed, first of all, at an increased **"all-day efficiency."** As is now quite well known, the losses constantly going on in a transformer are of two kinds—those due to the iron, and called "core" or "leakage" losses, and those due to the copper, and called "C^2R" or "copper" losses. The first arise from the fact that the transforming action depends on the magnetizing of the iron used in the transformer. This magnetizing requires energy—a good deal, or a little, depending altogether on the design. In the Type G an advance in design has been successfully

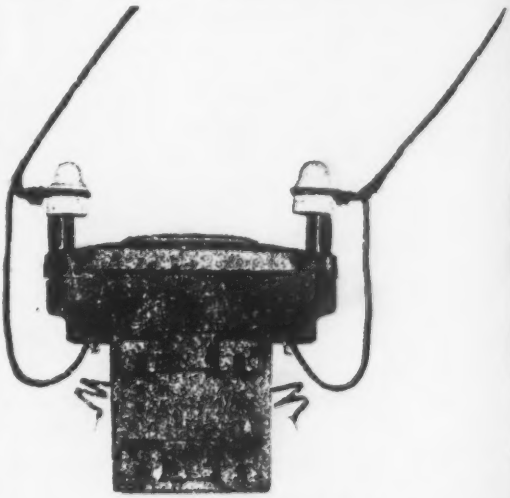


Fig. 40. Type G from back



Fig. 41. Type G without Case.

worked out, and the end accomplished has been the reduction of the "core losses" to a point unprecedented. The copper losses arise from the fact that the wire used in the transformer coils has resistance, and energy is lost when current is flowing. These losses, also, may be large or small, depending on the design of the transformer. In the Type G they are lower than in any well designed transformer ever built. In the "all-day efficiency," however, the iron losses play the most important part. By "all-day efficiency," be it understood, is meant the percentage which the energy used by the customer is of the total amount of energy sent into the transformer during twenty-four hours. This efficiency is generally based on the assumption that the energy used by the customer in twenty-four hours is the equivalent of full load on the transformer for five hours. The calculation of the all-day efficiency would, therefore, be made by the use of the following formula:

$$\text{All-Day E} = \frac{\text{Full Load} \times 5}{\text{Iron Loss} \times 24 + \text{Copper Loss} \times 5 + \text{Full Load} \times 5}$$

For example, the all-day efficiency of a 1000 watt transformer, the iron loss of which was 40 watts and the copper loss, at full load, 25 watts would be:

$$\text{All-Day E} = \frac{1000 \times 5}{40 \times 24 + 25 \times 5 + 1000 \times 5} = 82.1$$

From this it will be seen that the all-day iron losses amount to 960 watts, while the all-day copper losses but 125 watts. The importance of getting the iron loss as low as possible will, therefore, at once appear. That very material advance in this direction has been made in the Type G as compared with the Type D is evident from the curves in Fig. 55.

FULL LOAD EFFICIENCY.

Coincident with the increase in all-day efficiency has been an increase in efficiency at all loads. The full effect of this advance is evidenced very clearly in the comparative **Full Load** efficiency curves of Type D and Type G, as shown in Fig. 56. It will be seen that the improvement is a marked one in all sizes from the smallest to the largest. This gain is proportionately large on partial loads. The endeavor has been to produce at one step a transformer the inherent advantages of which would appear, whatever the direction of investigation.

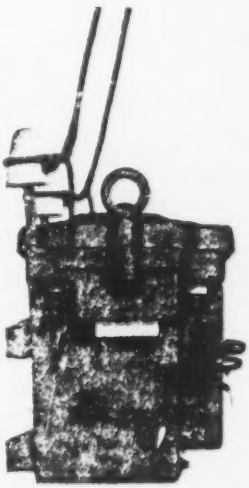


Fig. 42. Type G Side view.

REGULATION.

Regulation has not been sacrificed in any sense of the word in the new line as compared with the old. On the contrary, there has been a gain here. The percentage drop of secondary pressure between no load and full load has been materially scaled down. Good regulation in transformers is quite essential to the suc-

cessful operation of any lighting system, and this fact has not at any time been lost sight of. The position taken by this company, however, is that every other consideration in transformer design should not be sacrificed to regulation, as some manufacturers seem to believe, and in accordance with this policy, an average between "excessively" good regulation and permissible regulation has been established. The claim is made by some transformer users that the drop in a well designed transformer should not exceed 1 per cent at full load, regardless of the size of the transformer. Such a claim is an absurd one. Circumstances do occasionally arise, it will be conceded, under which such low drop is desirable; for example, where it is desired to compensate in the transformer for an excessive drop in a very long feeder. But in the usual central station practice, such a regulation is altogether unnecessary.

It may be well to consider briefly the expense involved in a transformer in securing a regulation of 1 per cent. Take, for example, a Wagner Co.'s Type D

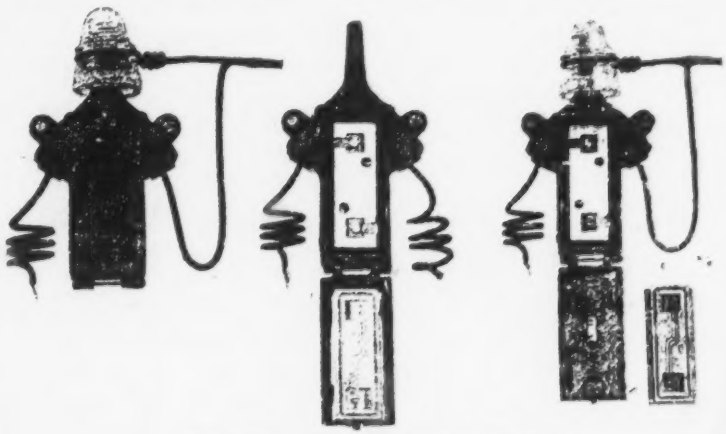


Fig. 43. Type XL Independent Cut-out Box.

20-lighter, which has a regulation of 2.9 per cent on 60 cycles. To secure a regulation of 1 per cent, it would be necessary to cut down the resistance of the windings to one-third their standard amount. Assuming that no change in the size of the transformer were made, this would mean that the number of turns of wire in the windings be reduced, and a larger wire in section used. The effect of decreasing the number of turns would be to greatly increase the iron loss. All in all, the transformation would change a very good transformer to a very poor one, as the following comparison will show:

	Iron Loss.	All-Day Eff.
Transformer with 2.9 per cent regulation.....	39 watts	82.2 per cent.
" " 1 " "	60 "	77.9 "

This difference in all-day service would mean that, for the sake of securing a transformer with a regulation of 1 per cent, the central station man would sacrifice each and every day the equivalent of ten incandescent lamps burning for an hour in a single 20 light transformer. With fifty such transformers on a single circuit, the loss would be one of considerable magnitude.

Only one method of securing a regulation of 1 per cent in this transformer without sacrificing the efficiency is open to the manufacturer, namely, a very great increase in the size of the transformer, and a consequent increase in cost. Few central station men care sufficiently for excessively low regulation in their transformers to be willing to bear the increased investment in transformer equipment. For these men, this company stands ready, at any time, to build special transformers to meet their specifications.

For the trade in general we have selected a regulation per cent which we deem all that good practice calls for, this being specified in tables appearing on pages 54 and 55. The average central station man follows the practice of installing a transformer capacity for each customer sufficiently large to meet his maximum

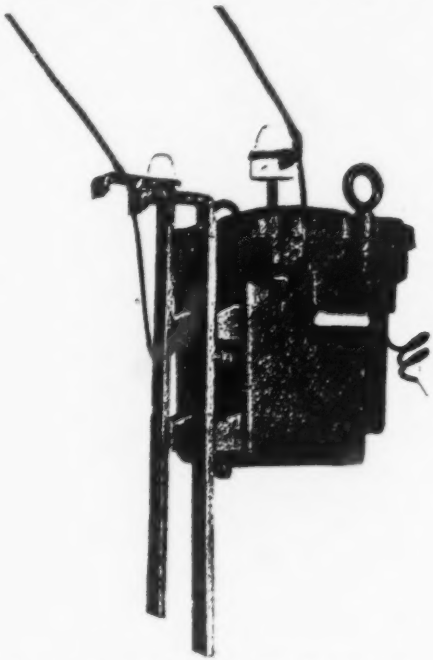


Fig. 44. Type G, showing method of suspension.

demand on the station. This means that nine out of ten transformers will seldom run at more than ¾ full load, and that a transformer listed with a regulation of 2.8 per cent will actually give in service only about 1.8 per cent. This fact the manufacturer takes into consideration, and by so doing is able to give the trade a transformer much superior in every other engineering detail than would otherwise be possible at the same, or even a reasonably greater cost. To the station man who is urged by a transformer builder to install his apparatus for the reason that he excels all competitors in regulation, we suggest that he look very carefully into the two items of core loss and all-day efficiency before he accepts the alleged superiority of the transformers offered him.

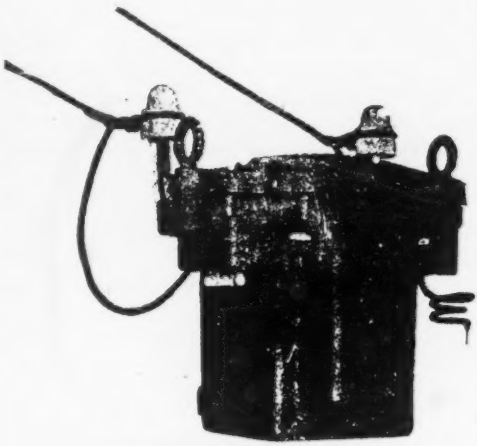


Fig. 45. Type G. Corner View.

MECHANICAL SUPERIORITY.

In the Type G we believe the best transformer from the standpoint of mechanical construction that has ever been built is offered to the trade. A careful examination of the illustrations in this circular will be convincing on this score. Attention is particularly called to the following features:

First: All leads are brought out vertically through the cases in such a manner as to preclude leakage, either electrical or of water. These leads, furthermore, are of the best quality of rubber covered extra flexible cable, and are protected by porcelain bushings of the most substantial nature where they come through the cases.

Second: The eye bolts which are required for handling the transformers serve also for holding down the lid.

Third: The arrangement for suspension is such that the hanger irons need not be permanently fastened to the transformer case. Furthermore, no tools of any kind are required for hanging. The hanger irons are provided with anchor bolts which easily slip into receptacles on the transformer case, making the operation of hanging exceedingly simple. See Fig. 44.

Fourth: All 2,000 volt transformers are provided with an interchangeable device on the interior of the case, enabling the connections to be easily changed for operation on either 1,000 or 2,000 volts as desired. This same interchangeable principle is employed upon the secondaries of all the smaller transformers, enabling them to be run on either 50 or 100 volts. This device is illustrated quite clearly in Fig. 50. Small copper links serve the purpose of completing the connections of the transformer coils to the outside leads. Simple changes in position of these permit the change of voltage. Many stations are now operating both 1,000 and 2,000 volt services. It means much to them to be able to carry but a single line of transformers which may be used on either. Other stations now operating a 1,000 volt service will eventually be changed over to 2,000 volts.

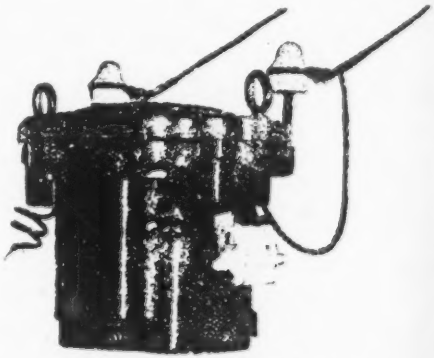


Fig. 46. Type G, showing Cut-out

When this change is made all transformers without an interchangeable device will have to be scrapped. The great value of the device will therefore appear.

Fifth: The transformers proper drop into the iron cases in an entirely new way, and are held securely against mechanical displacement in a very superior manner.

Sixth: All terminals of the windings are brought out without crossing.

Seventh: The line has been designed for use dry or oil filled. Transformers for 1,000 volts may be used in either manner, at the selection of the purchaser. For all 2,000 or higher voltage coils, oil is recommended. An examination of the illustrations will reveal that no mechanical changes in the cases to adapt them to either dry or oil service are necessary. They are, in fact, ready for use in either manner when shipped from the factory. The removable plug seen on the front side of the case, near the bottom, serves merely for the draining out of the oil when it is desired to shift a transformer from one place to another. This plug remains in position when the transformer is used dry as well as when oil filled.

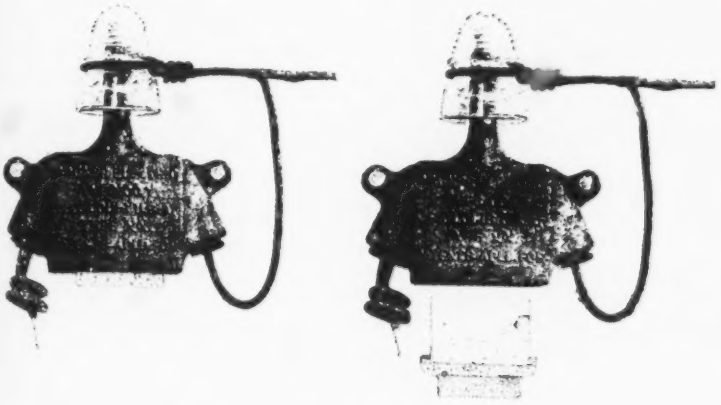
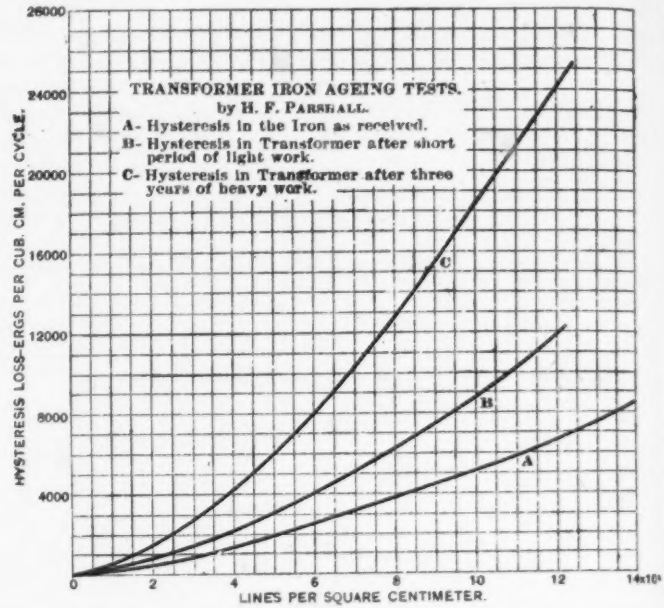
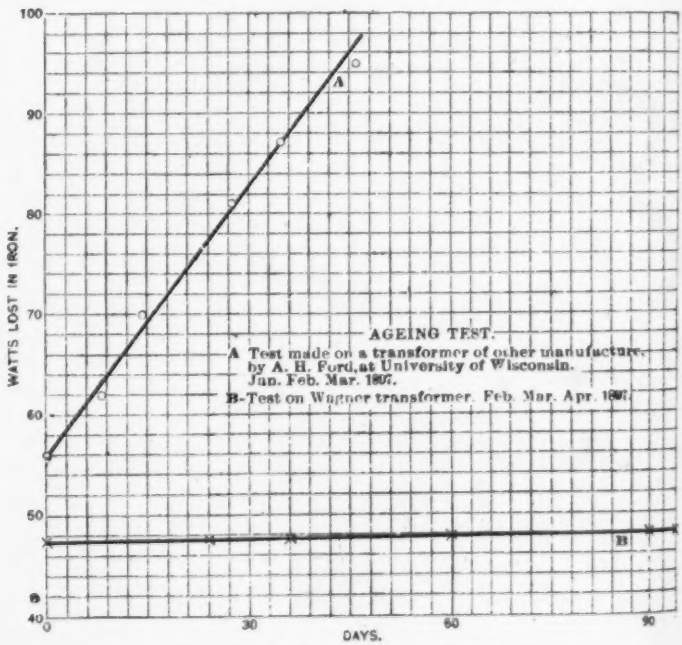


Fig. 47. Type XX Independent Cut-Out Box.

PRIMARY CUT-OUTS.

To meet every requirement of the trade, the line will consist of two forms. In one the primary fuse cut-outs will be attached on all sizes up to and including the 100 lighter. The other will be without cut-outs. The cut-out used in the attached cut-out line is the Type XX recently introduced in single pole independent box form. The fuse is carried in an air-tight tube within a removable porcelain plug. The general appearance of this plug is shown in Figs. 46 and 47. For independent primary cut-out service either the well known Type XL single pole or the more recent Type XX single pole box is recommended.





Figs. 48 and 49. Results of Ageing Tests.

INSULATION TESTS.

No better evidence of the thoroughness of the insulation of the transformer windings could be given than in the following specification for testing, which every transformer built in the Wagner Co.'s factory must meet:

	Alternating voltage required to withstand	
	Dry.	Oil-filled.
Insulation between primary and secondary	6,000	10,000
" " primary and case	6,000	10,000
" " secondary and case	6,000	10,000

Furthermore, every transformer is guaranteed to safely withstand, as an insulation test, the application to the primary of twice the voltage upon which it is to operate. In other words, 4,000 volts may safely be sent into every 2,000 volt transformer, and no harm will result. Such tests as these preclude the possibility of a defective transformer leaving the factory, and should any transformer be received by a purchaser which will not withstand them, the conclusion may be accepted that mechanical injury has been received in transit. Such injury is altogether improbable, for in the mechanical design of the Type G Transformer the security of the transformer proper against misplacement by jarring or otherwise has been most carefully guarded against. Moreover, the practice has been rigidly followed of sparing neither time nor material in the packing department in securely boxing all transformers for shipment.

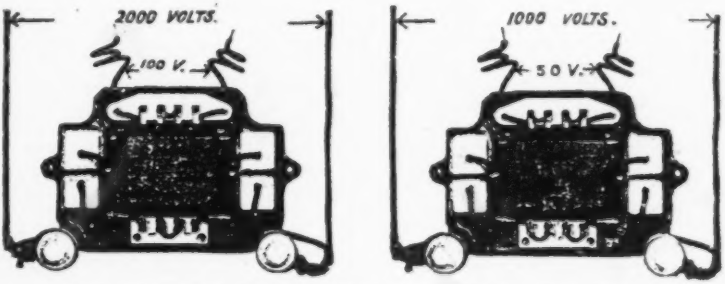


Fig. 50. Type G, showing Method of Interchanging Connections.

USE OF OIL.

This company very strongly advocates the use of oil in transformers. Experience has demonstrated the value of oil in several directions. The exclusion of the air from the windings, the great assistance in cooling afforded, and the very high insulating value of properly selected oil are its especially valuable qualities. In small sizes where the radiating surface of the cases is large as compared with the heat losses to be dissipated, a great volume of oil is not required. But in the larger sizes it will be noticed that a very liberal quantity of oil is used, for here it aids greatly in dissipating the heat. Safeguards in the use of oil are quite essential, however. Purchasing oil at random in the market, even of the grades suitable for transformer work, is a most hazardous proceeding, for such oil, in ninety-

nine barrels out of one hundred. will contain ingredients completely nullifying the qualities favorable to its use in transformers. For this reason, the guarantee on Type G Transformers only covers those in which the oil is supplied by this company. The practice is rigidly followed in the Wagner Co.'s factory of treating and testing by a special process all oil used for transformer purposes, which practice insures a quality of oil that can be depended on.

AGEING OF IRON.

Much has been said of late relative to the "ageing" of the iron in transformers. This phenomenon is a most interesting one, and has a very important bearing on the general worth of the transformer. That a gradual deterioration does take place in iron subjected to an alternating magnetism is no longer questioned, nor is any attempt made to decry the consequence of it, except upon the part of builders of inferior apparatus. The phenomenon is one this company has had under investigation for several years, conducting many series of tests through that interval to determine the extent of the ageing going on in its transformers. These tests have demonstrated that the ageing taking place in Wagner Co.'s apparatus is an almost inappreciable one, guarded against as it is by a most thorough maintenance of those special properties of the material which minimize the effect. As evidence of the deterioration that can take place in a transformer, two plates of curves are published herewith. Fig. 48 is extracted from the recent most valuable paper by Mr. H. F. Parshall on the subject of "Magnetic Data of Iron and Steel," presented to the London Institution of Civil Engineers. This test is one of considerable duration upon a single lot of iron. It will be noted that, in a period of two years, there was an increase of .200 per cent in the iron loss of the transformer in question. Fig. 49 presents recent data upon a Wagner Co.'s transformer and upon a transformer of other American manufacture. Mr. Ford's curve on the latter shows an increase of about 100 per cent in forty-five days, while in ninety days the change in the Wagner Co.'s transformer was but slightly over 1 per cent. We are prepared to guarantee all Type G transformers to show no marked deterioration in this respect within the period covered by other guarantees, namely, two years.

LIGHTNING.

Protection against lightning is one of the most serious problems confronting the central station man. He has come to realize finally that such a thing as absolute protection has not up to the present time been accomplished. He therefore expects that occasionally a transformer, however excellent its construction, will be burnt out during a lightning storm. There has not been, nor will there likely ever be a transformer built absolutely lightning proof. The Wagner Co.'s several lines have been as near proof, or nearer so, as have been any other. Appreciating, accordingly, that very few such burn outs will occur with this company's apparatus where a reasonable degree of line protection is afforded, we have made it a general practice to guarantee the purchaser against damage by lightning where satisfactory line protection by means of approved lightning arresters is afforded.

GROUND PLATE SHIELDS.

In some instances, engineers who do not desire to depend on the very high insulation between primary and secondary windings, specify the insertion of a metallic shield for the secondary coils. This shield is grounded to earth, and in case of any puncture of the insulation of the primary winding, all leakage current escapes directly to earth instead of to the secondary coils should their insulation also give way. Where such extra precaution is required, the Type G will be so constructed, the general design adapting itself excellently to this end. Such ground plates are not, however, recommended where their use can be avoided. To a certain degree the placing of them in a transformer invites breakdown of the insulation by lightning, for a direct path to earth is provided with nothing but the insulation of the primary coil intercepting. We deem it a far more profitable method of procedure for the station man to specify a very high puncture resistance between his transformer windings, one which will not fail under any but most extraordinary circumstances. Such a puncture resistance is embodied in the standard form of the Type G.

OVERLOADS.

While no good station superintendent makes it a general practice to overload his transformers, nevertheless occasionally circumstances arise making it inevitable to load a specific transformer beyond its rated capacity for a limited period. The Type G transformers can be safely overloaded 25 per cent for a period of three hours, without incurring damage to the insulation.

USING 60 CYCLE TRANSFORMERS ON 133 CYCLES.

The argument has at times been advanced by some of our competitors that a great element of superiority of their 60 cycle transformers lay in the fact that they can be operated on 133 cycles with 33 per cent greater output than the rated capacity on 60 cycles. As much can be said for almost any transformer. The several Wagner Co. s types can all be so used. The reason why this can be done is as follows: The iron loss in a transformer is much less on 133 cycles than on 60 cycles, while the copper loss with any given load is the same on both frequencies. Accordingly, on 133 cycles the load can be increased until the increase in copper losses is the same as the decrease in iron losses. The total losses, and, therefore, the heating effect, will then be practically the same on 133 as on 60 cycles. The question arises: Why has this point been made so little of, and particularly why has the Wagner Co. never advocated it? Simply for this reason: a 60 cycle transformer has a greater drop of secondary voltage on 133 cycles than on 60 cycles, **with the same load.** With 33 per cent greater load this drop is increased about 45 per cent. Obviously no station superintendent would care for an increased capacity at such a cost, and we have not deemed it to his advantage, in any sense, to advocate such a thing. We only advocate **the same load** on 133 cycles as on 66 cycles.

GENERAL RESULTS WITH TYPE G TRANSFORMERS.

The general results to be expected from the Type G transformers are specified below.

1,000 VOLT LINE—60 CYCLES.

Capacity.		Per Cent of Iron Loss.	Per Cent of Cu. Loss.	Per Cent of Regulation.	PER CENT EFFICIENCIES.							Trade Word.
Lights.	Watts.				1¼ Load.	1 Load.	¾ Load.	½ Load.	¼ Load.	1/10 Load.	All Day.	
10	500	4.39	2.5	2.75	93.77	93.55	92.82	90.89	84.61	69.37	80.92	Train.
20	1000	3.15	2.45	2.65	94.71	94.69	94.30	93.06	88.33	75.10	85.09	Tramp.
30	1500	2.57	2.25	2.50	95.36	95.40	95.13	94.10	90.22	79.41	87.27	Trip.
40	2000	2.32	2.05	2.30	95.74	95.81	95.58	94.64	91.08	81.08	88.35	Trial.
60	3000	1.875	2.00	2.30	96.15	96.26	96.16	95.46	92.59	84.06	90.03	Throw.
80	4000	1.61	1.8	2.10	96.56	96.70	96.62	96.04	93.56	85.99	91.28	Time.
100	5000	1.465	1.6	1.90	96.92	97.02	96.94	96.34	94.10	87.10	92.05	Tide
125	6250	1.3	1.6	1.90	97.05	97.18	96.90	96.71	94.65	88.37	92.72	Tool.

INTERCHANGEABLE 1,000 OR 2,000 VOLT LINE—60 CYCLES.

10	500	4.39	2.9	3.15	93.33	93.20	92.56	90.72	84.54	69.35	80.66	Transient.
20	1000	3.15	2.75	3.00	94.38	94.42	94.10	92.88	88.27	75.88	84.83	Trooper.
30	1500	2.57	2.60	2.85	94.98	95.08	94.95	93.94	90.15	79.39	87.05	Trapper.
40	2000	2.32	2.35	2.55	95.43	95.53	95.42	94.51	91.04	81.01	88.11	Trainer.
60	3000	1.875	2.25	2.50	95.84	96.03	96.02	95.35	92.55	84.05	89.88	Trailer.
80	4000	1.61	1.95	2.25	96.40	96.56	96.51	95.98	93.54	85.99	91.17	Transmit.
100	5000	1.465	1.8	2.10	96.69	96.83	96.86	96.31	94.09	87.07	91.88	Transom.
125	6250	1.3	1.8	2.10	96.81	96.99	96.99	96.61	94.66	88.35	92.56	Trespass.
150	7500	1.21	1.65	1.95	97.05	97.21	97.22	96.86	95.02	89.07	93.05	Tribute.
200	10000	1.00	1.6	1.90	97.28	97.46	97.53	97.27	95.78	90.77	93.98	Travel.
300	15000	.87	1.6	1.90	97.37	97.58	97.60	97.52	96.28	91.80	94.54	Treasure.

1,000 VOLT LINE—133 CYCLES.

Capacity.		Per Cent Iron Loss.	Per Cent Cu. Loss.	Per Cent Regulation.	PER CENT EFFICIENCIES							Trade Word.
Lights.	Watts.				1¼ Load.	1 Load.	¾ Load.	½ Load	¼ Load.	1/10 Load	All Day.	
10	500	3.32	2.50	3.00	94.54	94.50	94.07	92.69	87.81	74.96	84.44	Tame.
20	1000	2.40	2.45	2.95	95.25	95.37	95.21	94.32	90.74	80.51	87.74	Tan.
30	1500	1.99	2.25	2.75	95.78	95.93	95.84	95.14	92.14	83.20	89.28	Tap.
40	2000	1.80	2.05	2.55	96.16	96.29	96.20	95.58	92.86	84.60	90.34	Tall.
60	3000	1.45	2.00	2.50	96.47	96.66	96.67	96.24	94.09	87.18	91.77	Talk.
80	4000	1.24	1.80	2.40	96.86	97.04	97.11	96.73	94.87	88.88	92.80	Tail.
100	5000.	1.22	1.60	2.20	97.11	97.25	97.25	96.86	94.98	89.04	93.06	Tack.
125	6250	.99	1.60	2.20	97.29	97.54	97.54	97.29	95.82	90.90	94.02	Tab

INTERCHANGEABLE 1,000 OR 2,000 VOLT LINE—133 CYCLES.

10	500	3.32	2.90	3.40	94.09	94.14	93.82	92.52	87.07	74.91	84.14	Tenet.
20	1000	2.40	2.75	3.25	94.91	95.10	95.02	94.19	90.67	80.47	87.51	Tenant.
30	1500	1.99	2.60	3.10	95.39	95.61	95.62	94.98	92.08	83.22	89.16	Tennis.
40	2000	1.80	2.35	2.85	95.81	96.01	96.01	95.45	92.76	84.58	90.09	Tender.
60	3000	1.45	2.25	2.85	96.18	96.43	96.51	96.13	94.02	87.16	91.56	Tempie.
80	4000	1.24	1.95	2.55	96.68	96.90	96.99	96.67	94.84	88.81	92.67	Templet.
100	5000	1.22	1.80	2.40	96.88	97.06	97.13	96.76	94.94	88.98	92.85	Terrace.
125	6250	.99	1.80	2.40	97.05	97.28	97.42	97.20	95.78	90.84	93.85	Tensile.
150	7500	.91	1.65	2.25	97.29	97.50	97.61	97.42	96.11	91.31	94.32	Tension.
200	10000	.81	1.60	2.20	97.42	97.64	97.77	97.63	96.45	92.37	94.79	Tendril.
300	15000	.72	1.60	2.20	97.49	97.73	97.88	97.80	96.82	93.14	95.18	Texture.

It will be seen that two lines of transformers are above specified: 1,000 volt primaries, and interchangeable 1,000 and 2,000 volt primaries. Stocks of both lines will be carried at the several storerooms of the company.

Transformer Testing.

This company has always advocated the close testing of all transformers. We have claimed that a transformer should stand on its merits alone, and such faith have we had in our transformer product that we have entered gladly into any and all competitive tests from whatever source the competition came. This fearlessness has not been unwarranted, for test after test has resulted in our favor. Many of these dating back over a period of several years, might be published. Greatest significance, however, attaches itself, we take it, to recent tests, and we therefore take great pleasure in reproducing a fac-simile table of results secured in August and September in a series of tests made by the Municipal Electric Light Company,

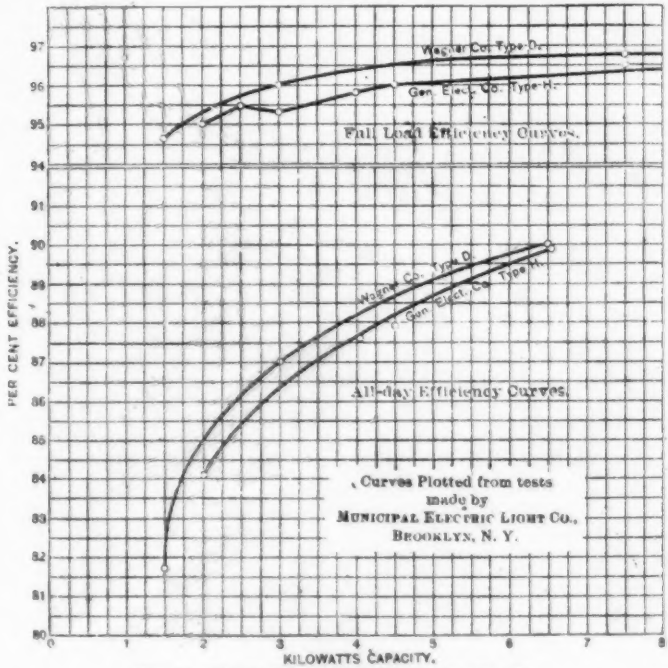


Fig 51. Curves Plotted from Results in Fig. 52.

of Brooklyn, N. Y. Close study of the table will reveal many points of superiority of the Wagner Co.'s apparatus. It will also be noted that the majority of Wagner Co's transformers were not the later Type G, but the Standard Type D line which has been in the field for several years. Knowing that these tests were to be conducted upon a competitive basis, this company endeavored to have its new line ready for it, but with the exception of a few small sizes, it was impossible to deliver on the Municipal Company's orders anything else than our old line of Type D sizes. This will explain why the competition really proved to be between the General Electric Type H and Wagner Co.'s Type D. Since results do not stand out as clearly

MUNICIPAL ELECTRIC LIGHT CO

TRANSFORMER TEST

Brooklyn N.Y. Oct 30th 1897

Location	Make	Type	Serial Number	Ratio	Cycles	Capacity K.V.A.	Capacity Watts	Iron Loss Volts	Iron Loss Total Watts	Iron Loss Watts %	Iron Loss Cycles	Copper Loss Volts	Copper Loss Current	Copper Loss Total Watts	Copper Loss Watts %	Impedance	Regulation	Total Losses	Efficiency Full Load	Efficiency All Day	Date
110	Gen El	H	88576	2000 / 52-104	60	20	1000	100	39.18	3.92	-	1000	1.00	29.70	2.97	91.1	3.015	68.95	93.81	89.03	189
111	Wagner	G	19752	1-2000 / 100-50	-	30	1500	104	40.26	3.68	-	1060	1.44	37.82	2.52	104	4.068	78.0	95.08	84.28	-
								200	33.69	2.37	-	1000	1.50	40.15	2.67	105	4.270	73.84	95.18	89.50	-
102	-	D	18084	"	-	30	1500	104	42.28	3.48	-	1040	1.44	40.1	2.67	47.5	2.193	82.28	94.23	87.03	-
								100	44.19	3.01	-	1000	1.50	42.3	2.82	48.4	2.878	87.19	94.48	86.71	-
112	-	D	18982	"	-	-	-	104	39.7	3.38	-	1040	1.44	39.84	2.23	47.5	2.660	83.7	94.56	87.64	10/18
								100	47.2	3.15	-	1000	1.50	36.00	2.40	49.3	2.469	83.2	94.80	87.46	-
104	-	D	18983	"	-	-	-	104	51.1	3.41	-	1040	1.44	32.00	2.13	41.35	2.184	83.1	94.79	81.56	-
								100	47.4	3.16	-	1000	1.50	34.10	2.67	43.4	2.337	81.5	94.84	88.46	-
228	Wagner	G	18751	2000 / 100-50	-	40	2000	104	46.78	2.33	-	1040	1.92	42.96	2.64	47.7	3.524	89.24	95.49	85.96	8/28
								100	43.49	2.18	-	1000	2.00	51.40	2.57	53.2	3.168	95.49	95.44	84.61	-
100	Gen El	H	96753	2080 / 52-104	-	-	-	104	58.68	2.80	-	1040	1.92	51.82	2.59	54.6	3.935	101.18	95.00	84.12	-
								100	49.19	2.46	-	1000	2.00	56.18	2.81	58.	3.893	102.33	94.93	83.06	-
229	-	H	95182	2080 / 115	-	-	-	115	52.8	2.07	-	2080	987	45.8	2.29	48.1	3.407	99.4	95.43	84.4	10/28
230	-	H	95871	"	-	-	-	115	50.9	2.44	-	2090	987	46.4	2.32	51	3.611	101.4	96.09	84.9	-
231	-	H	95730	"	-	-	-	115	58.2	2.48	-	2080	987	45.8	2.29	48.9	3.465	100.0	95.20	83.2	-
228	-	H	99221	2080 / 52-104	-	50	2500	104	61.28	2.45	-	1040	2.40	49.40	2.47	76.4	7.414	110.68	95.49	87.98	8/28
								100	56.44	2.257	-	1000	2.50	60.34	2.41	80.0	9.446	116.84	95.33	86.68	-
108	-	H	89509	"	-	-	-	104	53.88	2.211	-	1040	2.40	57.55	2.88	78.3	8.004	111.63	95.46	85.17	-
								100	59.19	2.369	-	1000	2.50	60.00	2.40	79.8	8.450	119.81	95.44	85.75	-
114	Wagner	G	19750	1-2000 / 100-50	-	60	3000	104	49.28	2.37	-	1040	2.88	71.4	2.38	95.0	12.410	144.68	95.64	86.68	-
								100	44.9	2.00	-	1000	3.00	72.28	2.57	96.3	12.000	157.07	95.60	87.31	-
245	-	D	16859	"	-	-	-	104	45.2	2.17	-	1040	2.88	78.00	2.71	103.4	13.041	168.5	96.05	86.99	4/5
								100	40.8	2.04	-	1000	3.00	68.5	2.28	95.0	12.12	148.9	96.05	87.86	-
227	-	G	19810	"	-	-	-	104	53.8	1.79	-	2080	1.44	73.5	2.56	96.8	9.370	146.1	95.86	87.7	-
								100	48.6	1.620	-	2000	1.50	74.9	2.496	95.5	9.471	144.4	95.85	89.1	-
228	-	G	19007	"	-	-	-	104	58.9	1.964	-	2080	1.44	69.1	2.31	92.5	7.986	128.4	95.96	87.6	-
								100	53.1	1.88	-	2000	1.50	77.0	2.57	97.25	8.615	136.4	95.17	87.9	-
221	Gen El	H	93400	2080 / 115	-	-	-	115	81.15	3.708	-	2090	1.44	67.00	2.23	94.0	9.497	198.15	95.06	86.79	9/30
235	-	H	97989	2080 / 1455 / 59-230	-	80	4000	119	77.6	2.94	-	2090	1.94	90.8	2.27	86.6	2.348	174.1	95.64	87.7	10/30
234	-	H	97988	"	-	-	-	115	77.2	2.983	-	2090	1.94	84.1	2.15	85.0	2.310	171.7	95.18	87.7	-
237	-	H	98275	"	-	-	-	115	77.5	1.998	-	2090	1.94	95.9	2.4	97.8	2.871	173.9	95.34	87.7	-
232	-	H	87096	2080 / 115	-	90	4500	118	85.45	1.900	-	2080	2.16	101.76	2.26	90.42	2.331	187.41	94.00	87.96	9/30
217	-	H	87097	"	-	-	-	115	88.18	1.958	-	2080	2.16	99.88	2.22	98.2	2.284	188.03	95.00	86.39	-
119	-	H	92038	"	-	-	-	118	84.45	1.877	-	2080	2.16	92.08	2.03	92.0	2.207	176.73	94.18	87.98	-
120	Wagner	D	19008	1-2000 / 100-50	-	150	7500	104	114.9	3.56	-	2080	3.6	126.3	1.82	57.9	1.617	251.2	96.74	89.8	10/28
								100	109.4	3.46	-	2000	3.75	109.5	1.98	60.4	1.765	229.0	96.64	90.3	-
126	-	D	19009	"	-	-	-	104	113.9	3.516	-	2080	3.6	123.0	1.77	55.4	1.673	240.8	96.84	90.1	-
								100	109.4	3.46	-	2000	3.75	105.7	1.948	59.4	1.722	228.1	96.71	90.3	-
240	Gen El	H	98460	1040 / 1080 / 52-208	-	-	-	104	120.4	1.74	-	2080	3.6	140.1	1.91	86.	1.830	274.5	96.48	89.16	-
								100	121.4	1.62	-	-									
96	-	H	98479	"	-	-	-	104	124.0	1.66	-	2080	3.6	140.3	1.92	86	1.924	264.3	96.00	89.32	-
								100	117.2	1.86	-										
278	-	H	99461	"	-	-	-	104	121.0	1.63	-	2080	3.6	142.6	1.94	87.7	1.826	264.3	96.09	89.86	-
								100	114.0	1.83	-										
232	Wagner	D	19099	1-2000 / 100-52	-	300	15000	104	188.8	2.187	-	2080	7.20	207.2	1.38	49.8	1.307	396.0	97.34	91.4	-
233	-	D	19100	"	-	-	-	104	204.8	2.378	-	2080	7.20	213.2	1.42	49.7	1.289	418.0	97.28	91.1	-
234	-	D	19097	"	-	-	-	104	191.8	2.079	-	2080	7.20	207.2	1.38	49.9	1.327	399	97.40	91.7	-

Fits All Day Efficiency - 4 hrs on Full Load & 20 hrs on No Load. Reg calculated by Kapp's Method.

K.P. Vogel.

Fig. 52. Fac-Simile of Transformer Test made by Municipal Electric Light Co., Brooklyn.

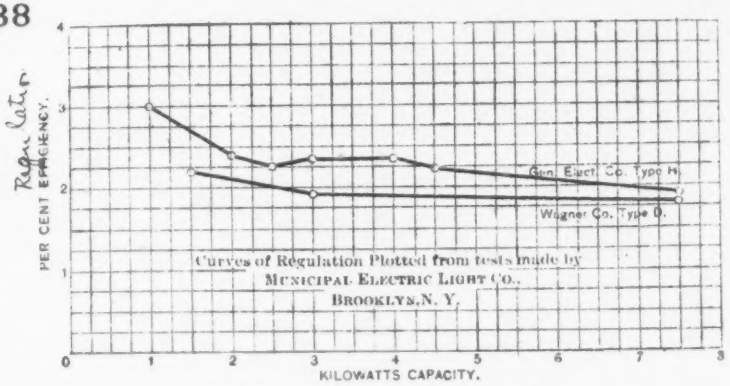


Fig. 53. Plotted from Results in Fig. 52.

to the eye and mind in tabulated form as in diagramatic form, the figures of the table are reproduced in a series of curves following. In Fig. 54 are given the comparative iron losses shown in the tables. It will be seen that the type D shows marked superiority over the entire range of capacities included in the tests. For example, a 3 kilowatt Type D showed an iron loss of 65 watts, while a General Electric 3 kilowatt showed 80 watts. The comparison reflects greatly to the credit of the Wagner Co.'s apparatus. More especially is this the case when the fact is considered that the General Electric Type H was but recently brought out, while the Wagner Co.'s Type D has been on the market for three years.

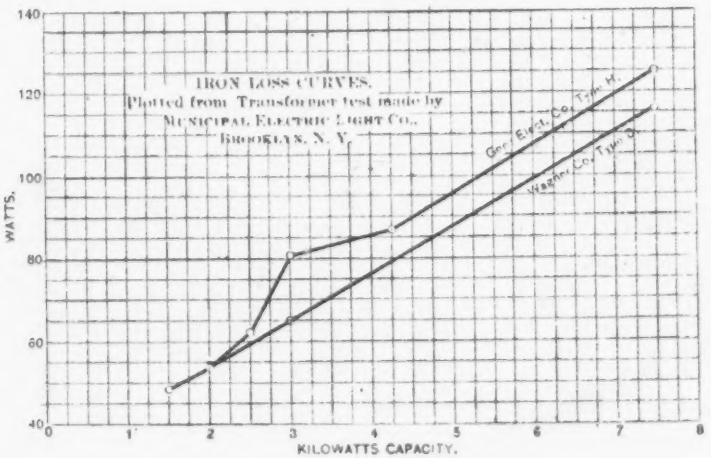
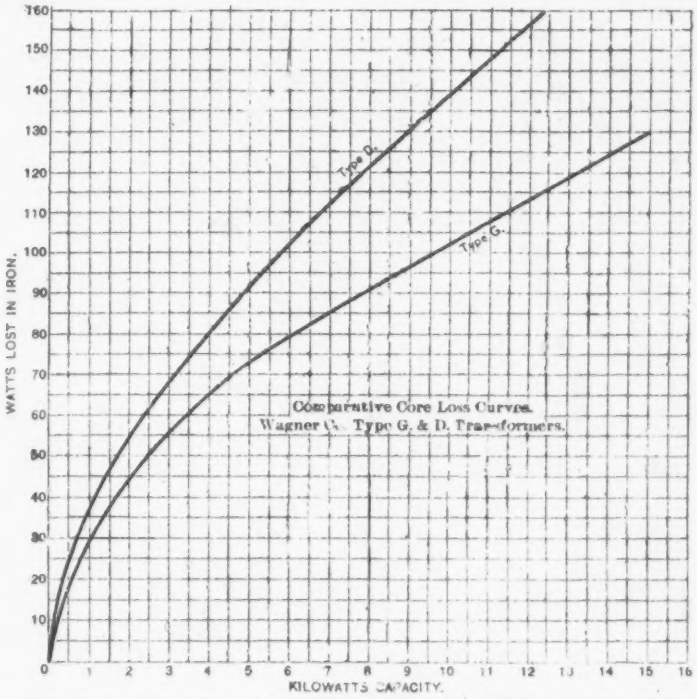


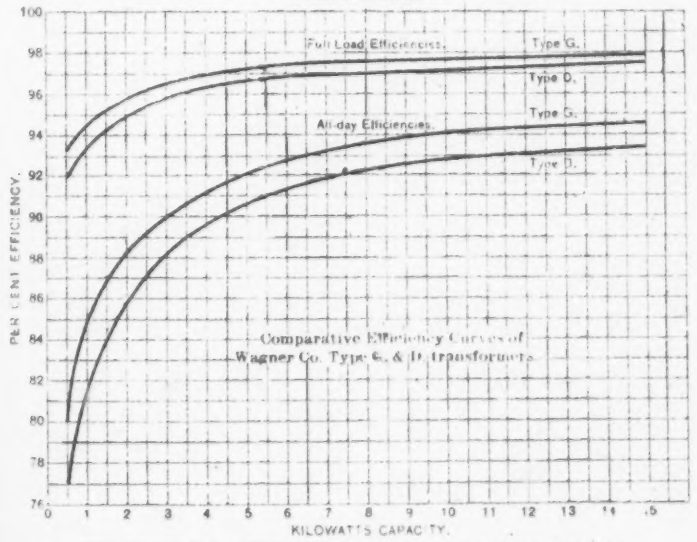
Fig. 54. Plotted from Results in Fig. 52.

Fig. 53 in like manner represents the relative regulation or "drop." Fig. 51 the relative all-day and full load efficiencies. These diagrams all speak for themselves in proclaiming the superiority of the Wagner Co.'s apparatus.

The final diagrams, Figs. 55 and 56 show the improvements in the Type G as compared with the Type D. In the Type G we believe we have offered to the

trade a transformer which not only can not be met by competitors with anything at present manufactured but which will stand for some time to come as the "only and the best."





Figs. 55 and 56. Comparison of Wagner Co.'s Types D and G

ESSENTIAL TESTS.

Every central station should have a record of the performance of its transformers. Such a record can be easily maintained, as the essential tests to be made are such as adapt themselves readily to station conditions and equipments. The instruments required for these tests are those frequently used on other kinds of testing about lighting and power plants, and the time required is relatively small. The most important test is the measurement of the "core" loss, or "leakage" loss. As before explained, this is the loss constantly going on in the transformer, whether the customer be using current from the secondary mains or not. Next in importance is the "regulation" test. These two tests at once disclose the electrical characteristics of the transformer, and will enable the station man to determine for himself the relative excellence of various makes of transformers offered him. Finally he should test the insulation of each transformer on its receipt from the factory.

THE CORE LOSS TEST.

The instruments required for this test are an indicating wattmeter and voltmeter. The Wagner Co.'s Type II instruments are admirably adapted to this purpose. We would recommend for core loss measurements a wattmeter reading up to 300 watts. For the voltage measurement a voltmeter with scale of from 90 to 120 volts. The method of test is to send into the secondary the rated secondary pressure, leaving the primary ends open. The source of current is usually the ordinary station lighting circuit, providing this is supplied from the generator on which the transformers are to operate or from another machine which generates the same frequency of current. By means of an adjustable rheostat the pressure at the terminals of the transformer under test is brought to exactly the rated amount. The wattmeter will, when connected in circuit according to instructions this company will take pleasure in furnishing, indicate the watts lost. It must be understood that the core loss on any two transformers of the same size is not necessarily the same, and that the results shown by any given transformers are not necessarily indicative of results to be expected from that make in general. **Every transformer should be tested for core loss.**

REGULATION.

This test is not so easily made. However, it is not necessary to make it upon every transformer. We recommend it only when the station superintendent desires to compare one make of transformers with another. The three things to be determined are: 1st—The ohmic resistances of the transformer windings. 2d—The voltage necessary to send the full load current through the transformer when the secondary is short circuited. 3d—The "leakage" current in amperes. These factors, when combined in the manner recommended by Dr. Bedell in his paper on Transformer Regulation (see Electrical World, Aug. 14, '97, "The Graphic Determination of Transformer Regulation with non-inductive load") give the regulation direct, by calculation. The ohmic measurements should be made with the Wheatstone bridge or with direct current instruments. We advise direct current instrument, in preference to the bridge on account of the low resistance of the sec-

ondary windings of transformers. The second factor, commonly called "impedance" voltage, calls for an ampere meter in addition to the volt meter and watt meter. We would recommend an instrument reading up to 10 amperes. The Type H ammeter will serve nicely for this purpose. The third factor can be determined by dividing the core loss in watts by the factor .65. This is not strictly accurate, but is a sufficiently close approximation for general work.

It is not necessary to test every transformer received for regulation, because the difference between any two transformers of the same size which are of the same detailed design—for instance, any two Wagner Co.'s 40 lighters received in one shipment—is negligibly small. The regulation is so largely determined by the resistances of the windings, which resistances are practically the same in all transformers of the same size and detailed design, that the bearing of the variable elements may be neglected.

INSULATION.

Insulation tests should be made for two reasons—first, to make sure that a defective transformer is not sent out on the line, and, second, to protect the purchaser from an inferior grade of apparatus. A small step-up transformer or set of transformers is required for this work. Such an outfit can be secured from this company. Station men desiring to test Wagner Co."s transformers will be given every assistance possible by this company. We ask for no fairer treatment at the hands of buyers than a close testing of our transformers. They are built to fulfill certain requirements imposed upon them in the factory, and do not leave the factory unless they actually meet these requirements. Accordingly we have no fear of them failing to meet our claims when subjected to rigid tests on the outside.

SPECIAL TRANSFORMERS FOR TESTS.

We have been informed that quite recently some of our competitors, who have failed to make the showing for their transformers in competitive tests against Wagner Co.'s Transformers expected by them, have built special lines for the specific purpose of surpassing Wagner Co.'s standard apparatus in tests. With reference to such practice, we have only this to say: The excellence of a line of transformers is based solely on the average performance of these transformers. The performance of a single selected or especially built set is absolutely worthless.

In bidding for an annual contract, or one for a specified number of lights capacity, or for a man's exclusive business, we do not ask the customer to decide the matter on the basis of results secured from a half dozen transformers. We say to him that we will guarantee every transformer sent out upon such a contract to come within specified limits, and if any transformer delivered fails to do this, we will replace it with one which will. We will submit a line for testing, if desired, taken from our stock rooms. Such transformers will be standard strictly, and as a rule will be found to be quite a good deal better than our specifications, for the specifications are not our best limits, but our worst.

244

No. 179.
Westinghouse
Wagner Co.

(No Model.)

G. WESTINGHOUSE, Jr.

ELECTRICAL CONVERTER.

No. 366,362. Patented July 12, 1887.

Fig. 2.

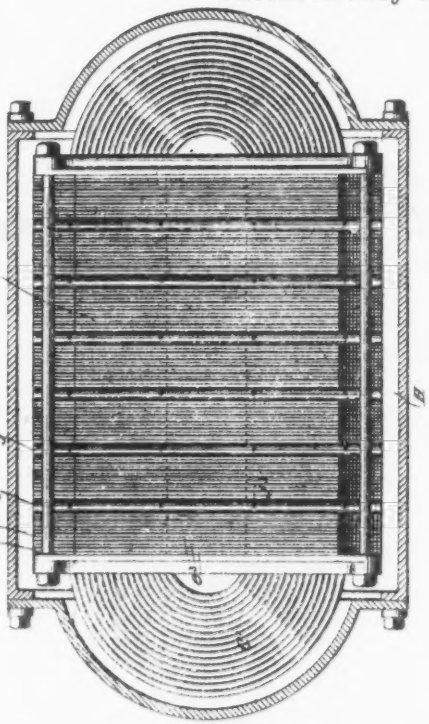
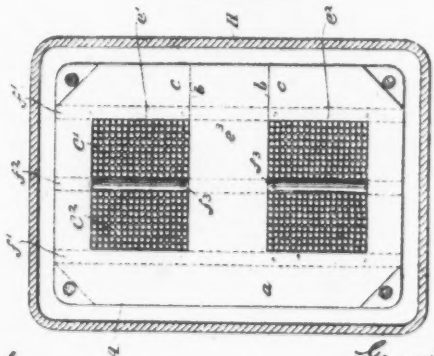


Fig. 1.



Witnesses
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By his Attorneys
Pope & Edgecomb

UNITED STATES PATENT OFFICE.

GEORGE WESTINGHOUSE, JR., OF PITTSBURG, PENNSYLVANIA.

ELECTRICAL CONVERTER.

SPECIFICATION forming part of Letters Patent No. 366,362, dated July 12, 1887.

Application filed December 27, 1886. Serial No. 222,536. (No model.)

To all whom it may concern:

Be it known that I, GEORGE WESTINGHOUSE, Jr., a citizen of the United States, residing in Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Electrical Converters, of which the following is a specification.

The invention relates to the construction of a class of apparatus employed for transforming alternating or intermittent electric currents of any required character into currents differing therefrom in certain characteristics. Such apparatus are usually termed "induction-coils" or "converters."

The object of this invention is to provide a simple and efficient converter which will not become overheated when employed for a long time in transforming currents of high electromotive force, and which will be thoroughly ventilated.

In the accompanying drawings, Figure 1 is a cross-section, and Fig. 2 is a longitudinal section, of a converter involving the features of the invention.

Referring to the figures, A represents the core of the converter, and C and C' the respective coils. The core is preferably composed of thin plates of soft iron *a a*, separated individually or in pairs from each other by thin sheets of paper or other insulating material. This insulating material is preferably applied to one surface of the plates by being glued or pasted thereto, and these surfaces may lie all in the same direction, thus separating the plates individually, or alternate plates may have their covered surfaces in one direction and the intervening plates have their covered faces in the opposite direction, thus magnetically separating the plates in pairs.

The plates are preferably constructed with two rectangular openings, *e'* and *e²*, through which the wires pass. For convenience in inserting the coils, or rather in applying the plates to the coils after the latter have been wound, a cut is made from each opening, as shown at *b b*. By bending the ends *c c* upward the plates may then be thrust into position, and the ends *c c* then close about the coils. The tongues *e²* of succeeding plates are preferably inserted from opposite sides. I do not, however, herein broadly claim an induction-coil having its core constructed of thin plates formed in the manner just described; but such invention is claimed in an application of even date herewith, filed by Albert Schmid. Each group of—say five or six—plates thus applied is preferably separated from the succeeding group by air-spaces. These may be produced by passing tubes *f' f'*, which may be of soft iron or other metal, or of vulcanized fiber, along the lengths of the plates. It may be sufficient in other instances to block the group of plates apart at intervals instead of extending the tubes the entire length. Preferably also the primary and secondary coils C C' are separated from each other in a similar manner. In this instance blocks or tubes *f²*, of non-conducting material, are used. The tubes may be perforated, as shown at *f² f²*. Where the converter is to be used in open air, the tubes *f'* and *f²* would permit a free circulation of air, and thus aid in keeping the converter cool.

It may be preferred in some instances to surround the converter with some oil or paraffine or other suitable material, which will assist in preserving insulation and will not be injured by heating. This material when in a liquid form circulates through the tubes and the intervening spaces of the coils and plates, and preserves the insulation, excludes the moisture, and cools the converter.

The entire converter may be sealed into an inclosing-case, H, which may or may not contain a non-conducting fluid or a gas.

I claim as my invention—

1. The combination, substantially as described, of a soft-iron core, and parallel primary and secondary coils having an open space intervening between them.

2. The combination, with the primary and secondary coils of an electric converter, of a core composed of laminæ of soft iron arranged in groups, said groups being separated by open spaces.

3. In an electrical converter, a core composed of soft-iron plates arranged in groups and open tubes intervening.

4. The combination, substantially as described, of an electric converter constructed with open spaces in its core, an inclosing-case, and a non-conducting fluid or gas in said case

adapted to circulate through said spaces and about the converter.

5. The combination, with the primary and secondary coils of an electric converter, of a core composed of magnetically-separated laminæ of soft iron arranged in groups, the different groups being separated from each other by air-spaces, and the laminæ of the several groups being arranged in different parallel planes.

In testimony whereof I have hereunto subscribed my name this 27th day of October, A. D. 1886

GEO. WESTINGHOUSE, Jr.

Witnesses:
CHARLES A. TERRY,
WALTER D. UPTEGRAFF.

174

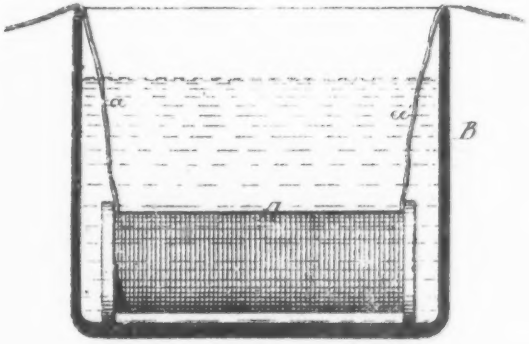
248

No. 179
Westinghouse
v.
Warner Co. } P. Mfg.

D. BROOKS.

Insulating Induction Coils.

No. 210,987. Patented Dec. 17, 1878.



Witnesses

Henry Howson Jr.
Harry Smith

Inventor

David Brooks
by his Attorneys
Howson and Son

* (Here follows diagram marked p. 248.)

UNITED STATES PATENT OFFICE.

DAVID BROOKS, OF PHILADELPHIA, PENNSYLVANIA

IMPROVEMENT IN INSULATING INDUCTION-COILS.

Specification forming part of Letters Patent No. **210,987**, dated December 17, 1878; application filed October 25, 1878.

* (Here follows diagram marked p. 249.)

To all whom it may concern:

Be it known that I, DAVID BROOKS, of Philadelphia, Pennsylvania, have invented a new and useful Improvement in Insulating Induction-Coils, &c., of which the following is a specification:

The object of my invention is to thoroughly insulate induction-coils or bobbins of wire of electrical instruments and protect them from the influence of the damp atmosphere. This object I attain in the manner which I will now proceed to describe, reference being had to the accompanying drawing, the figure in which illustrates a method of carrying my invention into effect. *

In the drawing, A is an ordinary induction coil or coils, or bobbins of wire, with their positive and negative poles *a a'*, and B is a vessel of any suitable shape or size, containing an insulating liquid, preferably paraffine-oil. I immerse the bobbins or coils, as shown in the drawing, and the coils, being kept thus immersed in the liquid, are protected from the influence of the damp atmosphere.

I claim as my invention—

The within-described method of insulating induction-coils or bobbins of wire of electrical instruments—that is to say, by immersing said bobbins or coils in a liquid insulating substance, as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

DAVID BROOKS.

Witnesses:

ALEX. PATTERSON.

HARRY SMITH.

252

No. 179
Westinghouse
Magneto

(No Model.) 2 Sheets—Sheet 1

R. C. HINDLEY & W. S. BUFFHAM.

DYNAMO ELECTRIC GENERATOR.

No. 266,290. Patented Oct. 24, 1882.

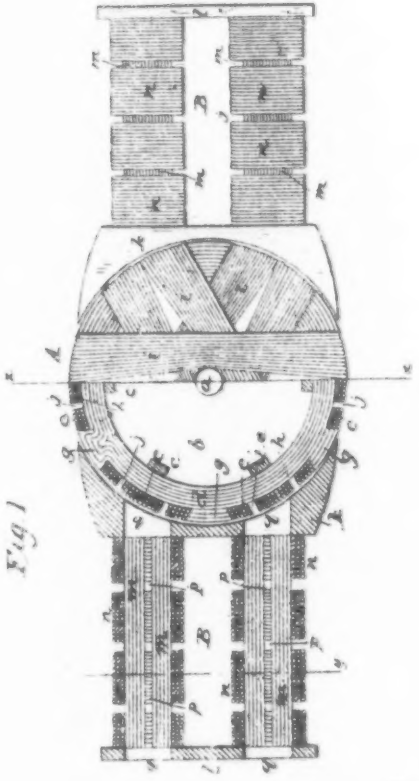


Fig 1

Attest.
Sidney P. Hollingsworth
Walter S. Dodge

Inventors.
Robert C. Hindley,
William S. Buffham
by Dodger Sons,
Attys

254

No. 19
Westinghouse
&
Wagner Co.

(No Model.) 2 Sheets—Sheet 2

R. C. HINDLEY & W. S. BUFFHAM.

DYNAMO ELECTRIC GENERATOR.

No. 266,290. Patented Oct. 24, 1882.

Fig. 2.

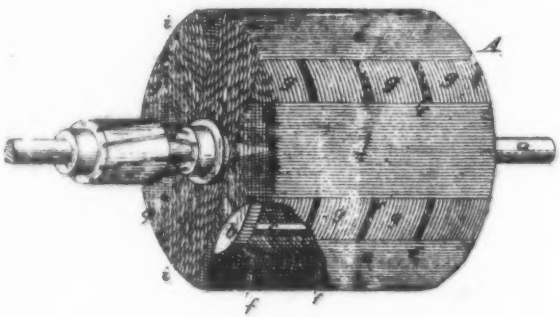


Fig. 3

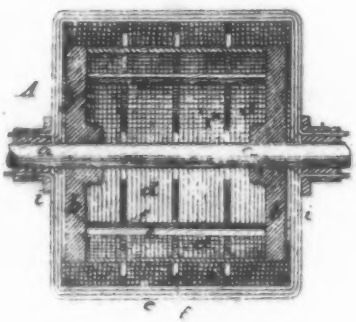
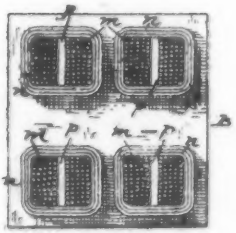


Fig. 4.



Attest.
Sidney P. Hollingsworth
Walter F. Dodge

Inventors.
Robert C. Hindley,
William S. Buffham,
by Dodger Son, Attys

UNITED STATES PATENT OFFICE.

ROBERT C. HINDLEY AND WILLIAM S. BUFFHAM, OF RACINE, WISCONSIN.

DYNAMO-ELECTRIC GENERATOR.

SPECIFICATION forming part of Letters Patent No. 286,290, dated October 24, 1882.

Application filed April 20, 1882. (No model.)

To all whom it may concern:

Be it known that we, ROBERT C. HINDLEY and WILLIAM S. BUFFHAM, of Racine, in the county of Racine and State of Wisconsin, have invented certain Improvements in Dynamo-Electric Generators, of which the following is a specification.

Our invention relates to dynamo-electric generators; and the improvements consist in forming the armature and field-magnets of wire bound together by a metal or other substance capable of insulating the wires magnetically, but not electrically; and in a novel manner of arranging the wires, whereby openings or spaces are provided for the free circulation of air in a composite field-magnet the pole-faces and back plates of which are formed of solid metal and the body portion of wire, and in other features and details hereinafter explained.

In the accompanying drawings, Figure 1 represents an end or side view of the revolving armature and field-magnets of a dynamo-electric machine embodying our improvements, one-half of said figure being shown in section; Fig. 2, a perspective view of the armature removed from the machine; Fig. 3, a vertical longitudinal section through the armature; Fig. 4, a cross-section of one of the field-magnets.

The objects of our invention are to secure rapid and perfect magnetization and demagnetization, and to overcome in a great degree the generation of heat in dynamo-electric machines. The first of these objects we propose to attain by constructing the body of the armature and magnets of bundles of wire bound together by non-magnetic material or substance, and the second by leaving or forming air-passages or openings in the iron-wire body, and the enveloping copper coils of both. These features of construction will be more perfectly understood by referring to the drawings, in which A represents the armature, and B B the field-magnets.

As shown in Figs. 1, 2, and 3, the armature A consists of a central shaft, *a*, upon which are mounted and secured circular heads or plates *b*, between which extend longitudinal ribs or bars *c*, to support the core *d*, formed of iron wire wound in sections or groups, and over or around which the copper induction-wire *e* is wound, as shown. The core *d* of the armature consists of a series of bundles or groups of wire coiled in layers around the ribs or bars *c*, and bound together by zinc, brass, or other non-magnetic substance capable of conducting electricity, either melted and cast upon and around the wires, as indicated, or wrapped in the form of ribbons or bands, the first plan being preferred. Spaces *f* are left between the bundles or groups *d*, at right angles to the shaft or axis of the armature-cylinder, and the wire is either bent outward and back, as shown at the upper side of Fig. 1, to form projecting pole-pieces *g*, or said pole-pieces may be formed by winding or coiling the core-wires to the circumference of the cylinder, and subsequently cutting away intermediate recesses, *h*, to receive the copper wire *e*, which is wound or wrapped into said spaces or recesses and across the ends or heads of the cylinder, as shown, a sufficient number of layers being wound on to bring the outer surface flush with the outer face of the pole-pieces *g*; or the pole-pieces may be formed by winding or piling the wires longitudinally and subsequently uniting them by the non-magnetic substance. In winding or wrapping the copper wire the same arrangement or plan is followed as in winding the coils *d*—that is to say, the wire is arranged in groups or bundles with intervening spaces, *j*. It will thus be seen that the spaces *f* and *j* cross each other at right angles, and that numerous and uninterrupted passages are thereby afforded for the travel of air from the outside to the inside of the armature-cylinder, or vice versa, both the core-wire bundles and the induction-wire bundles being exposed to the air on all sides. The armature thus constructed will not become highly heated and interfere with the efficient action of the machine, as often happens with various other constructions.

The field-magnets are constructed in a similar manner, except that the pole-pieces and the back plate are of solid metal, the core or body portion being of iron wire, as in the armature. This construction is illustrated in Figs. 1 and 4, in which B represents the magnet as a whole, *k* the pole-face, *l* the back plate or end piece,

* (Here follows diagram marked p. 244.)

182

m the core, and *n* the coil wrapped or wound upon the core, as shown. In this, as in the armature, the core-wires are divided into groups and the coils wound in sections or groups at right angles thereto, so that the spaces *o* between the groups of wire coils cross the spaces *p* between the core-wire bundles, thus affording a free inlet for the air throughout all parts of the magnet.

The pole-face block and the rear end plate may be drawn together and held in place by bolts or rods extending from one to the other, said parts being recessed to receive the ends of the wires; or the pole-face block and end plate may be cast upon the ends of the core-wire, as indicated, the latter construction being preferred. Openings *q* will be formed in the end plate and pole-faces opposite the spaces *p*, to permit the free entrance of air.

The core-wires *n* will preferably be bound together by a non-magnetic metal or substance, as in the armature.

In all points of construction and detail not herein fully set forth and explained the machine may be of usual construction.

We are aware that it is not broadly new to magnetically insulate the wires forming the coils—one coil from another—by a non-magnetic electric conductor; but, so far as we are aware, no one has ever before made the non-magnetic substance serve also as the binding material by which the core or armature is bound together.

We are also aware that the core of an armature has been made up of separated coils, and this we do not claim; but we believe ourselves to be the first to so construct a field-magnet of a dynamo-machine, or to combine with this feature that of winding the induction-coils of the armature or the enveloping-coils of the magnet in separated groups, so that air can freely circulate through them, and that we are the first to combine the armature and magnets thus constructed.

We do not broadly claim an armature-core composed of wire and provided with seats or depressions to receive the induction-coils, but only claim such core when the wires forming the body thereof are bound together by a fusible substance separating and enveloping them, as above explained.

Having thus described our invention, what we claim is—

1. An armature-core for dynamo-electric generators, composed of wire wound in coils, said coils being bound together and magnetically insulated from each other by a non-magnetic substance applied in a fluid state and allowed to set or harden.

2. An armature for dynamo-electric generators having a core composed of wires arranged in groups with intervening spaces, substantially as shown and described, the wires being magnetically insulated from one another and bound into a compact mass by a non-magnetic substance, substantially as set forth.

3. A dynamo-electric generator provided with a field-magnet having a core composed of wire arranged in groups or bundles, said bundles being separated by open spaces, substantially as and for the purpose set forth.

4. In a dynamo-electric machine, the combination of a field-magnet and an armature, both formed with cores of wire arranged in groups or bundles, said bundles being separated by open spaces, substantially as and for the purpose set forth.

5. In a dynamo-electric generator, a field-magnet having a core composed of separated bundles of wire and an enveloping coil or wire wound thereon in separated groups or bundles, whereby communicating air-spaces are formed through the induction-coil and core.

6. In a dynamo-electric machine, a field-magnet consisting of a wire core, solid end piece, and a surrounding coil, the wire of the core and of the surrounding coil being arranged in separated bundles or groups, as shown.

7. A core for magnets or armatures, consisting of a bundle of iron wires bound together by a non-magnetic substance passing between the individual wires, and thereby serving also to magnetically insulate them one from another.

8. The herein-described method of constructing cores for magnets and armatures, consisting in winding or arranging a series of wires side by side and at short distances apart, pouring between and around them a non-magnetic substance in a fluid condition, and permitting said substance to set or harden, and thereby to bind the wires into a compact body and to magnetically insulate them one from another.

9. The herein-described armature-core, consisting of wire wound or wrapped circumferentially in bundles or coils, united and formed into a solid body by a binding material applied in a fluid state and allowed to set or harden upon and between the wires, said core being formed with seats or recesses to receive the induction-coils, substantially as set forth and shown.

10. The herein-described dynamo-electric generator, consisting of armature A, provided with a wire core formed of separated sections, and with induction-coils, also wound in separate groups or bundles, and the field-magnets B B, provided with the solid end plates, divided wire cores, and coils wound in separated groups or bundles upon the cores, as explained.

ROBERT O. HINDLEY.
WILLIAM S. BUFFHAM.

Witnesses:
EUSTUS G. FISCH,
J. A. BEAUGRAND.

184

258

No. 179
Westinghouse } Pp. 258
Wagner

(No Model.)

A. B. FISHER.

ARMATURE FOR DYNAMO ELECTRIC MACHINES.

No. 269,036. Patented Dec. 12, 1882.

Fig. 1.

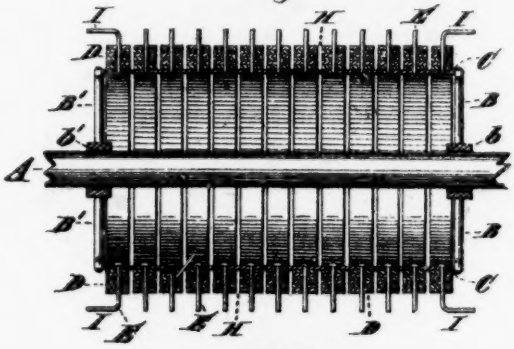


Fig. 2.

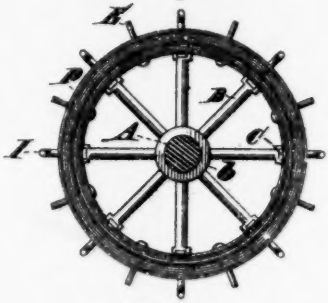


Fig. 3.



Attest
Jas. E. Jones
A. Ellicott Seely

Inventor
Andrew B. Fisher,
by Wood & Boyd
his Attorneys

UNITED STATES PATENT OFFICE.

ANDREW B. FISHER, OF UNION CITY, INDIANA.

ARMATURE FOR DYNAMO-ELECTRIC MACHINES.

SPECIFICATION forming part of Letters Patent No. 269,036, dated December 12, 1882.

Application filed July 26, 1882. (No model.)

To all whom it may concern:

Be it known that I, ANDREW B. FISHER, a citizen of the United States, and a resident of Union City, in the county of Randolph and State of Indiana, have invented certain new and useful Improvements in Armatures of Dynamo-Electric Machines, of which the following is a specification.

My invention relates to an improved armature of a dynamo-electric machine.

The object of my invention is to increase the efficiency of the armature by arranging the metal so that the entire mass will be subject to a more rapid magnetic change as it is revolved between the magnet-poles, and to cheapen and simplify the cost of the construction, all of which will be fully explained in the description of the accompanying drawings.

Figure 1 represents a longitudinal central section of my improved armature with the bobbins removed. Fig. 2 is an end elevation of the same. Fig. 3 is a detail elevation of one of the convolute ribbons and its series of polar pins.

A represents the shaft of the armature.

B B′ represent the spider-arms at either end of the armature, being secured to the shaft by hubs *b b′*.

C represents tie rods or strips of non-magnetic material, which are secured to arms B B′ in position parallel to the axis of the shaft, and form the base and supporting-frame for the inner periphery of the series of convolute ribbons.

D represents rings made of soft-iron ribbon, preferably insulated with any suitable substance before winding, and wound concentric to the axis and supported by the tie rods or strips C, to which they are attached by means of iron or other suitable pins or bolts, E, which are inserted through holes pierced in the tie-strips or cross-pieces C, and through the convolute ribbons D, which are pierced with suitable holes for the purpose. These pins are allowed to extend a considerable distance through and beyond the ribbons D to form polar projections of the armature. The rings D are placed a sufficient distance apart to allow air-spaces H, which provide suitable ventilation to the armature and prevent heating of the metal.

I represents bent extensions of the outer pins, E, which form suitable hooks, upon which are wound the wire-bobbins. Various methods may be employed for winding the bobbins of the armature. It may be wound either upon the Siemens or Gramme plan, as desired.

Either the hubs *b b′* or the tie-strips C should be insulated from magnetic connection with the shaft A, or the arms B′ should be made of diamagnetic material.

I claim—

1. An armature for dynamo-electric machines, composed of the frame A B C, the convolute iron rings or ribbons D, and the pins E, said rings or ribbons being separated to provide the air-spaces H, substantially as described.

2. An armature for dynamo-electric machines, composed of the frame A B C, convolute iron rings or ribbons D, and pins E, extending beyond the rings or ribbons to form polar projections, said rings or ribbons being separated to provide the air-spaces H, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

ANDREW B. FISHER.

Witnesses:
JAMES M. STARBUCK,
JOHN W. WILLIAMS.

262

No. 179.
Westinghouse & Wagner Sp. Mot

(No Model.)

A. MILLAR.

MAGNETO ELECTRIC MACHINE.

No. 270,457. Patented Jan. 9, 1883.

FIG. 6.

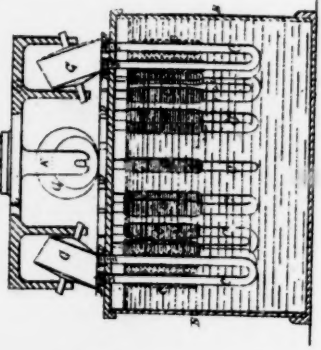


FIG. 5.

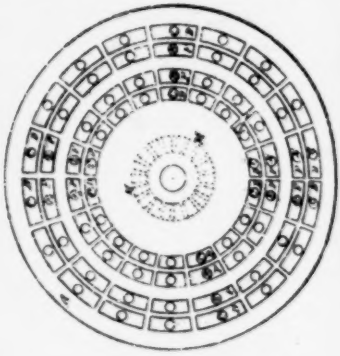


FIG. 3.

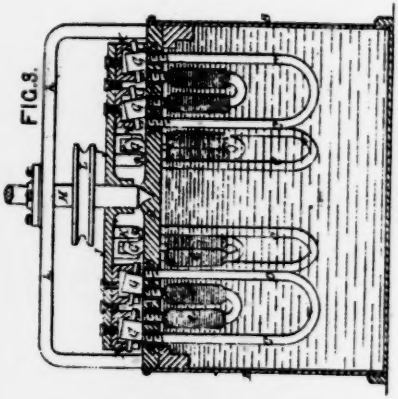


FIG. 4.

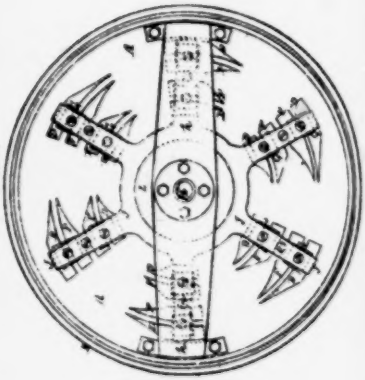


FIG. 1.

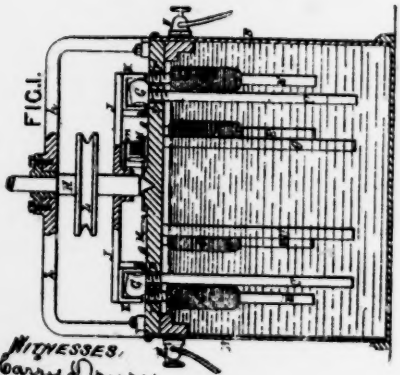
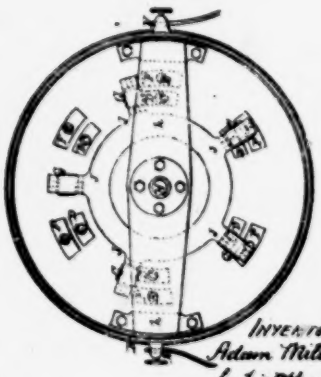


FIG. 2.



WITNESSES,
Harry J. Drury
Hamilton A. Turner

INVENTOR
Adam Millar
by his Attorneys
Howson and Sons

UNITED STATES PATENT OFFICE.

ADAM MILLAR, OF GLASGOW, SCOTLAND.

MAGNETO-ELECTRIC MACHINE.

SPECIFICATION forming part of Letters Patent No. 270,457, dated January 9, 1883.

Application filed July 3, 1882. (No model.) Patented in England October 29, 1881, No. 4,592.

To all whom it may concern:

Be it known that I, ADAM MILLAR, of Glasgow, Scotland, have invented certain Improvements in Apparatus for Generating Electric Currents, of which the following is a specification.

This invention relates to improvements in magneto-electric machines, and comprises an improved construction or arrangement and combination of the parts of a magneto-electric machine, which consists of a disk or circular plate of bronze or other non-magnetic metal resting on the sides of a cylindrical tank or cistern. A series of six or other number of permanent magnets is arranged in a circle concentric with the disk, having their poles terminating in pieces of soft iron, which are inserted into the disk and having their upper surfaces level with the upper surface of the disk. A series of six or other equal corresponding number of soft-iron bars is arranged in a second circle exterior to and concentric with the circle of permanent magnets. Each soft-iron bar is surrounded by a coil of insulated copper wire, which forms part of a closed circuit. These soft-iron bars terminate in pieces similar to the terminal pieces of the permanent magnets, and both sets of soft-iron terminal pieces are shaped so as to form segments of the circle in which they are placed. A series of soft-iron rollers, in number one less than the corresponding number of either series of magnets, rest on the surface of the disk, and are made to traverse a circular path on the surface of the disk by the rotation of an axis carrying the arms, which have forked pieces in which the trunnions of the rollers rotate. The length of the rollers is considerably greater than the space which separates the two circles of segments, so that they roll upon and form connecting-bars to each pair of segments as they pass over them. The axis of the arms carrying the rollers works between suitable bearings and carries a pulley, to which rotary motion is given by a belt driven by a steam-engine or other motor.

The action of the machine is as follows: The magnetism of the primary magnets is communicated to the cores of the secondary or electro magnets by the contact of the soft-iron rollers as they pass across the segmental terminal pieces on the disk during the rotation of the carrying-arms. Currents of electricity are produced in the coils of the electro-magnets at the instant of magnetization and of demagnetization, and these currents are collected by any suitable arrangement of commutators of the ordinary kind. As the magnetization produced by the contact of the soft-iron rollers with the primary magnets and the cores of the secondary magnets is of much greater intensity than would be the case if the magnets were merely made to approach each other without touching, the currents produced in the coils of the secondary currents are also of great intensity.

As the attractive force of the magnets acting upon the soft-iron rollers is very considerable at the moment when the rollers are just leaving the segments, the following arrangements are adopted, either separately or in combination, to enable this attractive force to be overcome and allow the arms carrying the contact-rollers to be rotated by a comparatively small expenditure of power:

First. By making the space or distance which separates the rollers from each other different from the space or distance which separates the segmental pieces, so that only a few of the rollers shall be on the point of leaving segments at the same instant of time. In an arrangement of the machine in which there is a series of six primary and six secondary magnets, and the space between the segmental pieces is the sixth part of the circle, while the space separating the rollers from each other is the fifth part of the circle, in each case measuring from center to center, only one roller is at the point of leaving a segmental piece at the same instant of time.

Second. By altering the shape of the soft-iron contact-pieces so that the parts which first make contact with the rollers may be of a segmental shape, as before; but the remaining parts may be made to be gradually brought to a point at a considerable distance from the limb of the magnet in the one circle and a considerable distance from the core of the electro-magnets in the other circle. The attractive force acting at the points is greatly reduced in comparison to the attractive force developed in the arrangement of segmental contact-

pieces first described, and the force required to move the rollers at the instant of leaving the points is reduced in proportion. This method, however, will greatly reduce the strength of the currents which arise during the demagnetization of the soft-iron cores, as by this arrangement the demagnetization is comparatively gradual and not instantaneous.

Third. By arranging the segmental pieces of soft iron very close to each other, so that a very small space separates them in comparison with the diameter of the soft-iron rollers. This arrangement allows the magnetization of the secondary or electro magnets to be maintained at a high degree of intensity up to the instant of demagnetization, while the force required to move the rollers from off one segment onto the next one is comparatively slight.

In order that the several improvements may be more easily understood, the primary and secondary magnets have been referred to as magnets acting by one pole only; but it is not intended that the improvements should be confined to magnets of that form.

The improvements are also applicable to what are commonly called "horseshoe" magnets, in which both poles operate equally. When the primary and secondary magnets are of the horseshoe form the magnetization of the secondary magnets is effected by the contact of two separate rollers, each roller making contact with one pole of the primary magnet and one pole of the secondary magnet. Both rollers are by preference driven by the same arm and move simultaneously. Also, the primary magnets have been assumed to be permanent steel magnets; but the improvements are equally applicable to electro-magnets magnetized by currents of electricity obtained from a source outside of or separate from the machine now described, acting alone or in combination with currents produced by the secondary magnets of the machine.

In order that the heat which is developed during the working of such magneto-electric machines when driven at a high speed may not interfere with the efficiency of the machine by reducing the conductivity of the wires forming the coils, I fill the tank or cistern on which the disk rests with water or other heat-absorbing liquid, so that the cores and coils of the electro-magnets are immersed in and surrounded by the water or other liquid, thereby keeping the coils from becoming heated to any considerable degree; and if the heat-absorbing liquid be a non-conductor—as, for example, paraffine-oil—the wires of the coils may be insulated with a covering of cotton or of silk in the usual manner; but if the heat-absorbing liquid be a conductor of electricity—such as water—then in order that the water or other liquid may not be in contact with the wires of the coils, and so lessen the insulation of the wires, I make the coils of wire water-proof in addition to being insulated. For instance, wires are first covered with cotton or silk threads, and are secondly coated with wax, paraffine, or other water-proof and non-conducting material applied to the silk or cotton covering.

* (Her. follows diagram marked p. 262.)

*In the accompanying drawings, Figure 1 shows a sectional elevation, and Fig. 2 a corresponding plan, of a machine for producing electric currents, constructed in accordance with my invention.

A is a plate of bronze resting on the edges of an open cistern or tank, B, filled with water.

C C C are a set of permanent magnets, attached to the segmental pieces of soft iron D D D. E E E are soft-iron bars, connected to the segmental pieces of soft iron F F F. Both series of segmental pieces D and F are ranged in equal numbers and on the same radial lines in a circle, having their upper surfaces level with the upper surface of the plate A.

A series of rollers, G G G, of soft iron, are traversed in a circular path in either direction on the surface of the disk A, and come into contact with the segments D F simultaneously, the length of the rollers being somewhat greater than the space which separates the two series of segments. The traveling motion of the rollers is obtained by a band from a steam-engine or other prime mover acting on the pulley L, keyed onto the shaft H, working in suitable bearings in the plate A and bracket h. The shaft also carries the arms J J, terminating in the forked pieces K K, in which the trunnions of the rollers G rotate. The shaft H is concentric with the circles of the segments and perpendicular to the surface of the disk A. The soft-iron bars E E E are each surrounded at the end nearest the segments by a coil of insulated copper wire, which forms part of a closed circuit. When the shaft H is made to rotate in either direction the magnetism of the magnets is communicated to the soft-iron bars E E E by the rollers G G G making contact with the segments D and F; and currents of electricity are produced at the instant of magnetization and again at the instant of demagnetization, when the rollers move off the segments. The currents are collected by a suitable arrangement of commutators, M, and brushes *m*, as indicated in the central part of the disk A, which communicate with the terminals. The heat which is produced in the coils of wire is absorbed by the water or other liquid in the tank as fast as it is produced, so that the wires remain at a comparatively low temperature, even when generating currents of electricity sufficient to cause a considerable amount of heat, while the contact-making devices and other moving parts of the machine are free from the water, and their motion not impeded thereby.

In the arrangement shown in Figs. 1 and 2, five arms J, fitted with rollers G, are caused to traverse over six sets of permanent and electro magnets C E; but any other corresponding numbers may be used—such as, for example, eleven revolving arms and twelve sets of magnets.

Figs. 3 and 4 show a sectional elevation and plan, respectively, of one modification of the machine in which the primary magnets C are made of a horseshoe shape and the secondary magnets E, of soft iron, also of horseshoe shape, so as to utilize both poles of the magnets, each pole of the magnets being surrounded by coils of insulated wire. The segmental pieces D and F in this arrangement are made so as to be gradually tapered to a point at one end, so that the attractive force acting on the rollers will be gradually lessened as the rollers traverse them, and allow the rollers to be moved off the segmental pieces with a comparatively small expenditure of power. This arrangement, however, will reduce the strength of the current which arises when the rollers leave the pieces. The direction of motion of the series of rollers G is indicated by the arrows on Fig. 4. The revolving arms and rollers correspond in number to the sets of magnets and segmental peices D F.

Fig. 5 is a plan of the plate A and segmental pieces D F, showing another arrangement for lessening the attractive force of the magnets upon the rollers. The magnets are increased in number so that the ends of the segmental pieces D D and F F are very near to each other, and the rollers G G roll in either direction from off the one onto the other with comparatively little expenditure of power. The commutators are indicated by the radial plates M.

It is to be understood that instead of the permanent steel magnets C, mentioned as the "primary" magnets, electro-magnets may be used, their magnetism being produced by electric currents obtained from galvanic batteries or other sources of electricity.

Fig. 6 is a vertical section, showing an arrangement in which the electro-magnet form of armature is dispensed with, and the electric currents are produced in coils of insulated wire *c*, surrounding each of the two limbs of the primary magnets C. The poles D of the magnets C are made close together, and the iron roller G alone forms the armature. Electric currents are produced in the coils of wire *c c*, surrounding the limbs of the magnets C C, at the instant when the iron roller G makes simultaneous contact with the poles D of the magnets C, and also at the instant when the roller G ceases to make contact with the poles D.

I claim as my invention—

1. In a magneto-electric machine, the combination of permanent magnets, temporary electro-magnets having coils in the working circuit, and pole-pieces for both magnets, with a rotating contact-maker adapted to simultaneously make contact with the pole-pieces of the permanent and temporary electro-magnets, substantially as and for the purpose set forth.

2. In a magneto-electric machine, the combination of permanent magnets, temporary magnets having coils in the main circuit, and pole-pieces D F, with revolving arms carrying rollers G, adapted to make contact with the said pole-pieces, substantially as described.

3. In a magneto-electric machine, the combination of contact-makers with permanent and temporary magnets having pole-pieces extending from the limbs of the magnets and tapering or gradually reduced in bulk from said limbs, substantially as specified.

4. The combination of the stationary electro-magnets and the moving parts of a magneto-electric machine, with a receptacle containing liquid in which the coils of the field-magnets are directly immersed, while the moving parts are out of contact therewith, substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ADAM MILLAR.

Witnesses:

W. R. M. THOMSON,

JOHN SIME,

Both of 96 *Buchanan Street, Glasgow.*

No. 179.
Westinghouse Ap. 206.
Wagner

(No Model.) 5 Sheets—Sheet 1

A. G. WATERHOUSE.

ELECTRIC INDUCTION MACHINE.

No. 271,169. Patented Jan. 23, 1883.

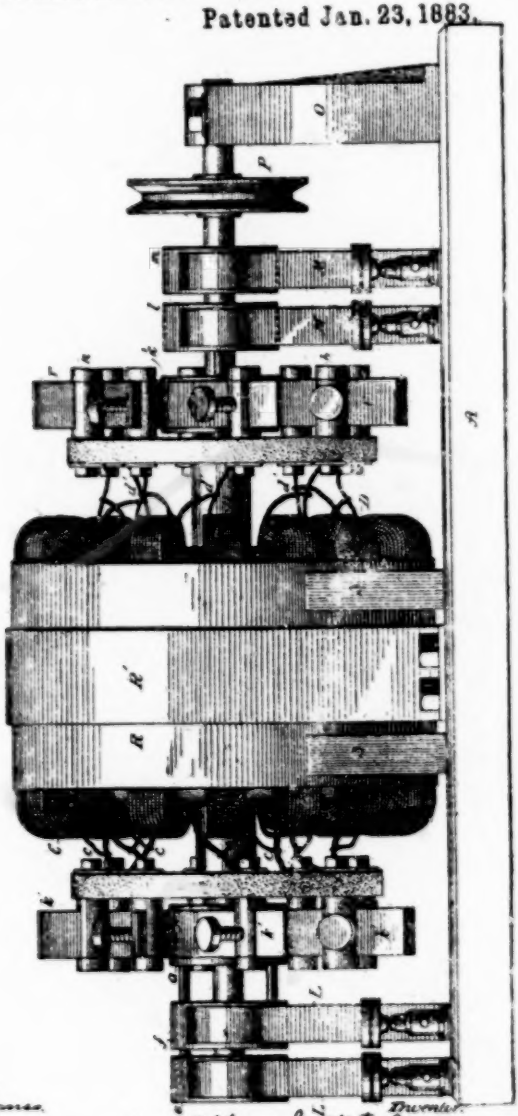


Fig. 1.

Attest:
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Henry A. Brockmeyer.

Addison G. Waterhouse
Dunwoody & Page Atty.

196

270

No. 179.
Westinghouse Co. } p. 270
Wagner Co.

(No Model.) 5 Sheets—Sheet 2.

A. G. WATERHOUSE.

ELECTRIC INDUCTION MACHINE.

No. 271,169. Patented Jan. 23, 1883.

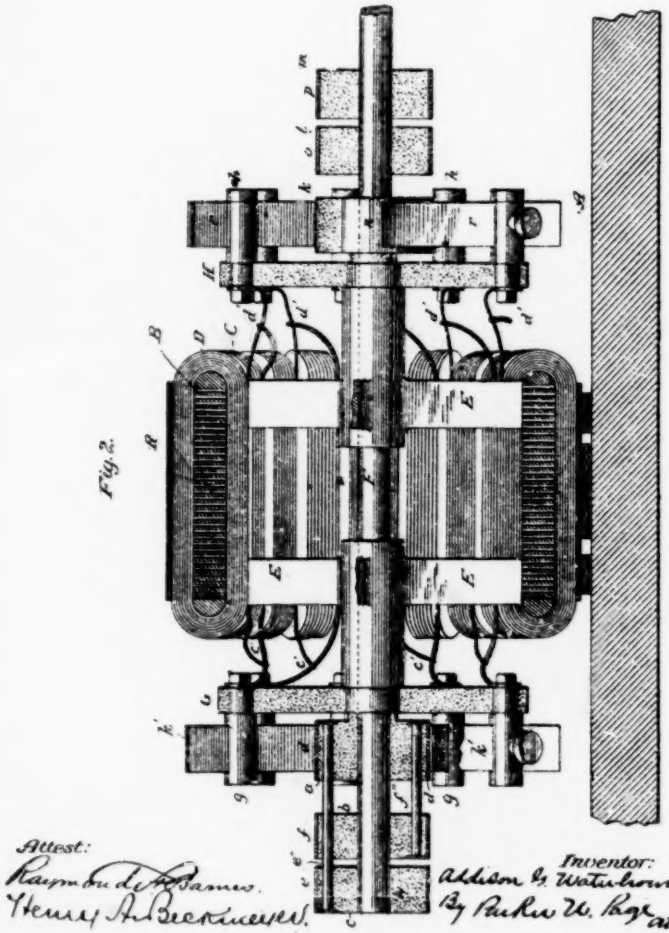


Fig. 2.

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198

272

No. 11a.
Westinghouse
v.
Wagner.

(No Model.) 5 Sheets—Sheet 3.

A. G. WATERHOUSE.

ELECTRIC INDUCTION MACHINE.

No. 271,169. Patented Jan. 23, 1883.

Fig. 4.

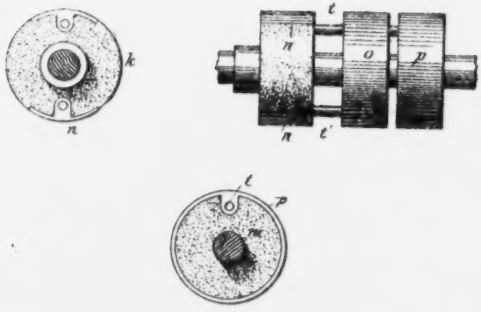
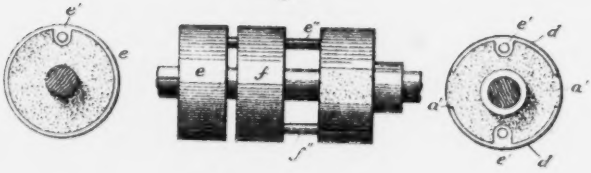


Fig 3.



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Addison G. Waterhouse

By Parker W. Page

Atty.

274

No. 17a.
Westinghouse Co. vs. Wagner Co.

(No Model.) 5 Sheets—Sheet 4

A. G. WATERHOUSE.

ELECTRIC INDUCTION MACHINE.

No. 271,169. Patented Jan. 23, 1883

Fig. 6.

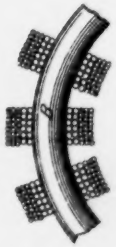
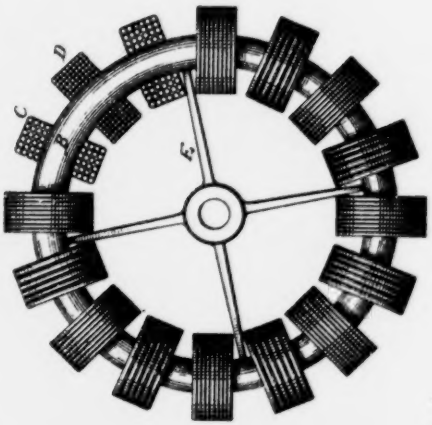


Fig. 5.



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Henry A. Beckmeyer.

Inventor:
Addison G. Waterhouse
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276

No. 179.
Westinghouse
v.
Wagner Co.
Sp. 796.

(No Model.) 5 Sheets—Sheet 5.

A. G. WATERHOUSE.

ELECTRIC INDUCTION MACHINE.

No. 271,169. Patented Jan. 23, 1883.

Fig. 8.

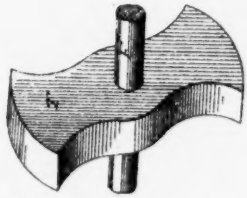
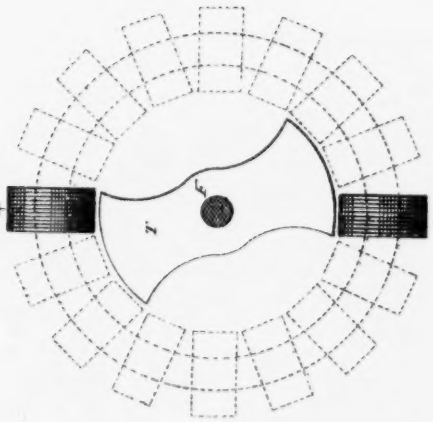


Fig. 7.



Attest:
Raymond F. Barnes.
Henry A. Beerbower.

Inventor:
Addison G. Waterhouse
By Parker W. Page
atty.

UNITED STATES PATENT OFFICE.

ADDISON G. WATERHOUSE, OF NEW YORK, N. Y.

ELECTRIC-INDUCTION MACHINE.

SPECIFICATION forming part of Letters Patent No. 271,169, dated January 23, 1883.

Application filed October 24, 1882. (No model.)

To all whom it may concern:

Be it known that I, ADDISON G. WATERHOUSE, a citizen of the United States, and a resident of New York, in the county and State of New York, have invented certain new and useful Improvements in Electrical Machines, of which the following is a specification, reference being had to the drawings accompanying and forming a part of the same.

My invention is based on the principle of magnetic induction as exemplified in the following case: A well-known type of magneto-electric generator contains poles of opposite polarity, constituting the field, and an iron ring wound with an arbitrary number of bobbins, and constituting the armature. The former are stationary. If, then, the latter be rotated or moved so that the coils are brought successively under the influence of opposite poles, electrical impulses will be generated in the armature-coils. Though the iron ring is revolved, the points of maximum magnetic intensity remain fixed with respect to the field, so that they are, so to speak, continually traveling around the ring. If the ring be held stationary and the field-magnets revolved, the same effects are produced; or if the ring and field both be moved and the coils held stationary the same results follow. In all cases there is what may be called a "movement" in the same direction of the most highly-magnetized portions of the armature with respect to the coils. My object is to effect this movement without rotating either armature or field, and this I accomplish in the following manner: On an iron ring or band I wind any desired number of coils similarly to the plan followed in the construction of the well-known Gramme armature. These coils are then connected up in two continuous series, alternate coils being looped together on opposite sides of the ring. The two series of loops are then connected, in a manner hereinafter specified, to commutating devices, one of which introduces a current to one series of coils in such manner as to magnetize all portions of the ring successively, while the other takes off the currents that are developed in the second series of coils by the movement of the magnetic poles. The specific means which I have devised for carrying out this invention are illustrated in the accompanying drawings, where—

Figure 1 illustrates in side elevation the apparatus complete. Fig. 2 is a central longitudinal section of the same, with parts shown in elevation. Fig. 3 illustrates in elevation and by end views the commutating devices, by means of which the current is introduced to one series of coils. Fig. 4 is a similar illustration of the devices for taking off the current. Fig. 5 shows in elevation and part section a modification of the ring and coils. Fig. 6 is a sectional view of a portion of another modification of the ring. Fig. 7 is an end view of a device for imparting motion to the commutator-shaft, and Fig. 8 a perspective view of the same.

Similar letters of reference indicate corresponding parts in all the figures.

A is the base upon which the apparatus is mounted; B, a ring or cylinder of iron, iron and insulating material, or iron plates with air-spaces, similar in construction to the ordinary Gramme ring.

C is an arbitrary number of coils wound upon the ring in the manner shown, and D an equal number of coils wound in the spaces between them.

R is a band, of metal or other material, surrounding the coils, and R' a strap binding the whole tightly in a seat formed by the curved blocks S S.

E E are metal spiders within the ring B, through the hubs of which passes a spindle, F.

G H are two plates, of insulating material, fixed to the hubs of the two spiders E E, respectively, and in said plates are set binding-posts *g h*, corresponding in number and position to loops *c' d'*, that are formed by connecting the ends of the two series of coils C D.

Fixed to the spindle F, beyond the plate G, is a commutating device consisting of three disks of insulating material, *a b c*. In the surface of disk *a* are set two metal plates, *d d*, that leave the diametrically-opposite spaces *a'*. Disks *b c* are surrounded by complete rings *e f*, of metal, and rods *e'' f''*, passing through the disks and riveted to ears *e' f'* on the several rings and plates, connect electrically the ring *e* with one of the plates *d* and the ring *f* with the other.

278

The posts *g* carry brushes *k'*, that bear on the disk *a*, and two brushes, L L, secured to the base A, bear on the metal surfaces of the disks *b c*.

On the opposite side of the ring B a similar arrangement of commutating devices is fixed to the spindle F. The disks *k l m* are employed, the first having plates *n* set in its surface, the last two provided with continuous rings *o p*. Rods *t* connect ring *o* and ring *p* with the upper and lower plates, *n*, respectively.

Posts *h* carry brushes *r*, that bear on the disk *k*, and brushes M M, fixed to base A, press on the disks *l m*. The disk *k* differs from disk *a* from the fact that the plates *n* on the former are considerably narrower than the plates *d* on the latter, and the disk *k* is fixed to the spindle so that the plates *n* lie opposite the spaces *a'* on the disk *a*.

A pulley-wheel, P, is fixed to the spindle F, and a standard, O, is employed to afford a bearing on the pulley end of the spindle.

If the springs L L be connected with the terminals of an electric circuit and the spindle F revolved, the current will pass from the rings *e f* to the plates *d*, and from these, by means of brushes *k'*, posts *g*, and loops *a'*, to the coils C. The plan of connection of these latter together and to the brushes will evidently produce poles of unlike polarity at diametrically opposite points in the ring B, and these points will always lie in the plane that passes through the center of the plates *d d* of the disk *a*. As the disk *a* revolves, therefore, the current will be directed in opposite directions through the coils C successively, and the points of maximum magnetic attraction caused to travel around the ring B.

Any change—such as an increase, a decrease, or a reversal of the magnetism of the core or ring B—obviously gives rise to electrical impulses of greater or less intensity, according to the character of the magnetic changes in the system of coils designated by the letters D D. If, while the current is flowing through the coils C, the shaft F be turned, these changes take place in the ring B, owing to the change in position of the maximum points. As a result, electrical impulses are induced in coils D, which flow in opposite directions, and are taken off by the plates *n n* on disk *k* as they move around in contact with the brushes *r*. From plates *n* the currents are taken by rods *t* to the disks *l m*, from whence they are conducted off by the brushes M. In this manner a current of impulses all in the same direction is obtained, which may be applied to many useful purposes. It is evident that its character relatively to the main or inducing current may be easily determined by the length of the coils D, so that a current of great quantity may be converted into a current of high tension, or the converse, besides which various other useful applications of the device are possible.

The specific construction of the apparatus may be in many ways varied. Particularly is this true with respect to the nature and disposition of the two systems of coils. For example, in Fig. 5 the two systems are shown with their coils independent and alternating. In Fig. 6 an arrangement is shown in which one system of coils under or over lies the other, and these arrangements may be still further varied, as may be found necessary or convenient. It is evident, too, that instead of an annular core a cylindrical one may be employed, the coils being wound around the same longitudinally from opposite ends, and connected to brushes in a similar manner to that above described; or in this, as in the case described, the several coils of a system, in lieu of being connected together, may be independent of one another, after the fashion of an open-circuit machine. It may be remarked in this connection, however, that the plates *n* and *d* on the disks *a* and *k* would under this arrangement have to be shifted ninety degrees from the position occupied by them in the present case.

In Figs. 7 and 8 a device for rotating the commutator-shaft is shown. This device, which does away with the pulley, may be used to great advantage. It consists of a simple bar-armature, T, fixed to the shaft F at an angle to the plane passing through the center of plates *d d* of the disk *a*, so that it will always be in the position shown in Fig. 7 relatively to the points of maximum magnetic attraction. It therefore acts as a simple electro-magnetic motor, and keeps the shaft F revolving as long as a sufficient amount of current is flowing therein.

By the employment of one or more devices such as I have now described, in conjunction with a dynamo-electric machine, it is obvious that the capacity of the latter in certain respects is greatly increased, as by dividing its current and passing it through the said devices currents of widely-different character may be produced.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination, with a stationary annular or cylindrical core, of two systems of coils, a commutator for passing a current in opposite directions through the coils of one system successively, and a collector for taking off the currents induced thereby in the other system, substantially as herein set forth.

2. The combination, with a stationary annular or cylindrical core, of coils wound thereon and connected together in two independent series; a revolving commutator and connections from the same to one of said series, whereby an electric current may be passed in opposite directions through the coils successively, a revolving collector, and connections from the same to the other system of coils, whereby the induced currents may be taken off from said coils, substantially as herein set forth.

3. The combination of a stationary annular or cylindrical core, two systems of coils wound

thereon, two sets of insulated brushes connected with the coils, a revolving commutator in contact with one set of brushes, whereby a current may be passed through the same in opposite directions successively, and a collector in contact with the second set of brushes for taking off the currents induced in the system of coils with which they are connected, as set forth.

4. In an apparatus of the kind described, the combination, with the stationary core, the two systems of coils, and brushes connected therewith, of a revolving shaft, a commutator, a collector, and an armature carried thereby, these parts being constructed and combined in substantially the manner herein set forth.

5. The combination of core B, the systems of coils C D, and the brushes $k' r'$, connected to the coils in the manner described, the disks $a\ k$, plates $d\ n$, and means for maintaining the latter in electrical contact with opposite circuit-terminals, as and for the purpose set forth.

6. The commutating and collecting devices consisting in the combination of three disks, one carrying two insulated plates, the others continuous rings connected respectively with the insulated plates in substantially the manner described.

In testimony whereof I have hereunto set my hand this 20th day of October, 1882.

ADDISON G. WATERHOUSE.

Witnesses:

HENRY A. BECKMEYER,

PARKER W. PAGE.

282

No. 19.
Westinghouse
Wagner Co.
1887

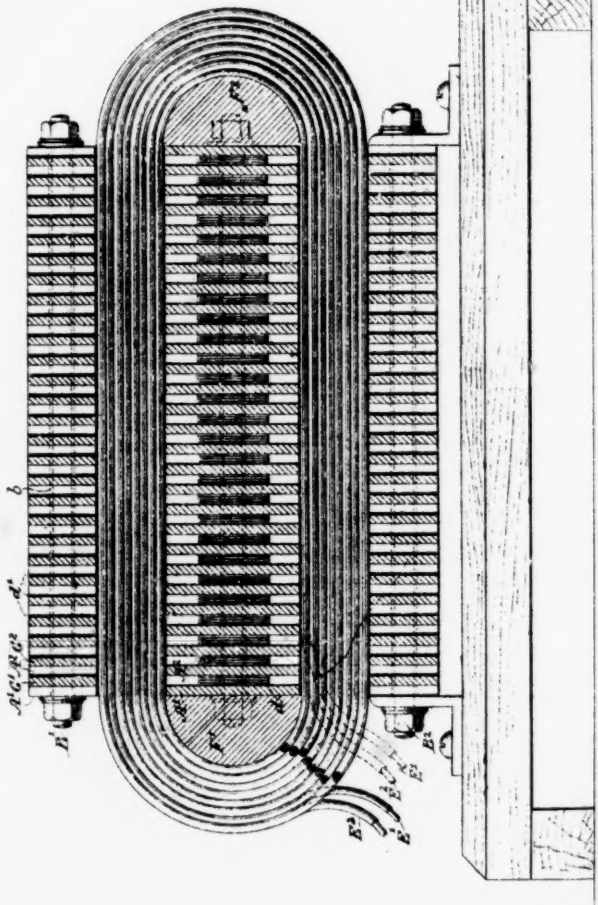
(No Model.) 3 Sheets—Sheet 1.

G. WESTINGHOUSE, Jr.

INDUCTION COIL.

No. 342,553. Patented May 25, 1886.

Fig. 1.



Witnesses
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Carrie E. Ashley

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George Westinghouse Jr.
By his Attorneys
Popet & Edgecomb

No. 171
Westinghouse Jr. Pat.
Wagner Co.

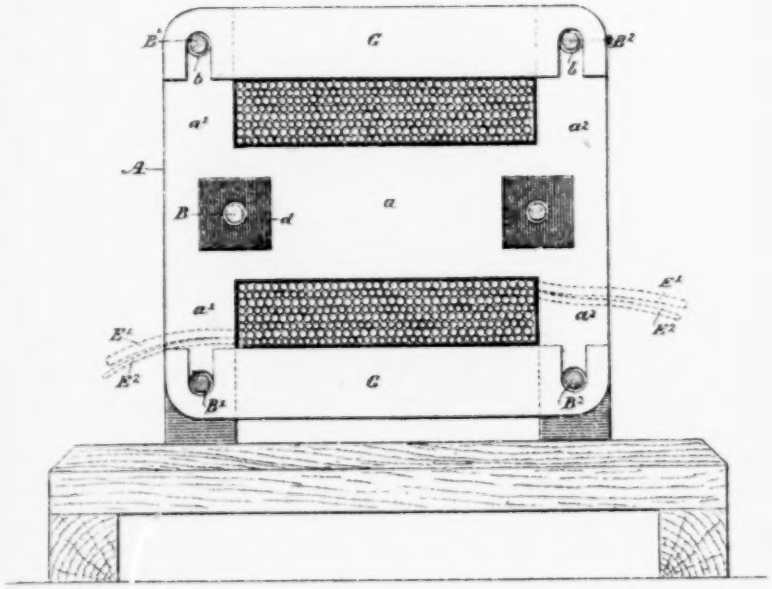
(No Model.) 3 Sheets—Sheet 2.

G. WESTINGHOUSE, Jr.

INDUCTION COIL.

No. 342,553. Patented May 25, 1886.

Fig. 2.



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286

Nov. 79.
Westinghouse } Sp. 286
Wagner

(No Model.) 3 Sheets—Sheet 3.

G. WESTINGHOUSE, Jr.

INDUCTION COIL.

No. 342,553. Patented May 25, 1886.

Fig. 4.

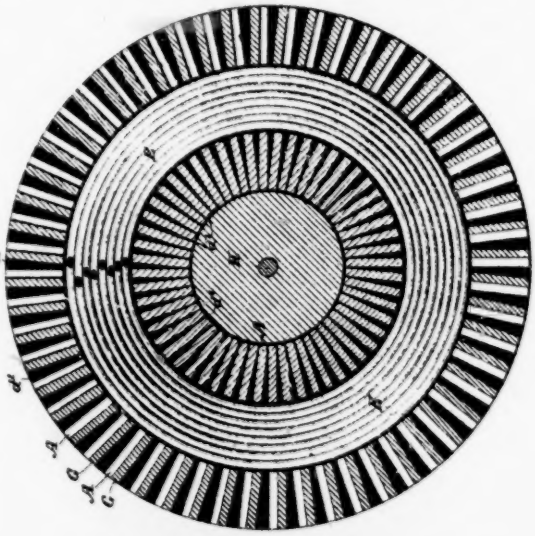
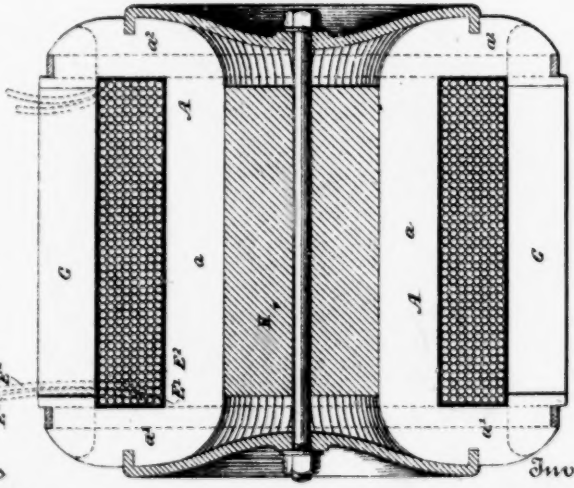


Fig. 3.



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Carne E. Ashley

Inventor
George Westinghouse Jr.
By his Attorneys
Pope & Edgecomb

UNITED STATES PATENT OFFICE.

GEORGE WESTINGHOUSE, JR., OF PITTSBURG, PENNSYLVANIA

INDUCTION-COIL.

SPECIFICATION forming part of Letters Patent No. 342,553, dated May 25, 1886.

Application filed February 10, 1886. Serial No. 192,071. (No model.)

To all whom it may concern:

Be it known that I, GEORGE WESTINGHOUSE, Jr., a citizen of the United States, residing in Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Induction-Coils, of which the following is a specification.

My invention relates to the class of electrical apparatus commonly employed for transforming electric energy of another form.

It has long been customary to employ induction-coils or converters for transforming electric currents of considerable quantity and low potential into currents of high potential and small quantity, but the conversion of high potential currents into currents of low potential without modifying the quantity is equally practicable, and also the conversion of currents of a given quantity into currents of greater quantity. Whatever be the particular form of conversion required, it is desirable that the entire current in the primary circuit be utilized in developing magnetism in surrounding iron, and that this magnetism shall in turn be expended upon the secondary coils and develop the greatest possible amount of current therein. To bring as large an amount of iron into as close proximity as possible to the primary and secondary coils, and yet construct the converter in such manner that there shall be but little loss of energy through heating the iron, and to render it capable of rapid charge and discharge is the object of the present invention.

The invention consists in constructing a converter in substantially the following manner: A number of thin soft-iron plates, each consisting of two parallel end pieces connected together by a central web, are bolted together side by side. The plates are separated from each other by intervening washers or plates of non-magnetic material—such as vulcanized fiber—and an air-space may be left, if desirable, between each two plates. The bolts are surrounded by tubes of vulcanized fiber or other non-magnetic material, or they may themselves be of non-magnetic material, such as brass. Preferably, however, vulcanized fiber is employed for separating the plates from each other and from the bolts, or some equivalent material which will serve to separate them electrically as well as magnetically.

Where large continuous masses of iron are rapidly magnetized and demagnetized they become heated, and there is a consequent loss of electrical energy. The thinner the plates are made the less will be the energy expended in heating them. For this reason the plates of which the core is composed are themselves made quite thin, and this construction also permits the coil to charge and discharge quickly. In the open space formed by the end pieces and the webs of the series of plates the primary and secondary conductors are wound, preferably, in alternate layers. After the spaces have been filled by the convolutions of these conductors outside plates of soft iron are placed between the arms of the outside arms or end pieces, and these serve to inclose or completely surround the conductors by a mantle of iron. The outside plates are respectively in magnetic contact with corresponding foundation-plates, but insulated from all the others. Each foundation-plate, therefore, in conjunction with the outside plate, forms a complete ring about the primary and secondary conductors. The plates may be arranged in a straight series, being placed side by side and in parallel planes, or they may be formed in a cylindrical series radiating from a common center. In the latter case each plate would have arms extending from one side only.

In the accompanying drawings, Figure 1 is a cross-section of an induction-coil or converter embodying the features of the invention; and Fig. 2 is an elevation of the same, partly in section. Fig. 3 is a longitudinal section, and Fig. 4 is a cross-section, of a modified form.

I am aware that the primary and secondary conductors of a converter have been surrounded by masses of soft-iron composed of magnetically-separated soft-iron disks, through which the conductors are led.

Referring to Fig. 1, A' A', &c., represent thin plates of soft iron, which may be conveniently formed by stamping. Each plate consists of a central web, *a*, having T-shaped ends. The arms *a' a'* and *a'' a''* of the latter project in opposite directions from the web, and form therewith two rectangular spaces, designed to re-

ceive the wire of the primary and secondary coils. The plates are bound together, side by side, by longitudinal bolts B' B' and B² B²; but they are separated slightly from each other by washers *d' d'*, surrounding the bolts. The bolts themselves are preferably surrounded by tubes *b*, of vulcanized fiber, and the washers are preferably of the same material. Instead of having the washers surround the bolts merely, they may be extended to cover the entire surfaces of the plates A' A', &c. The primary and secondary conductors E' and E', respectively, are wound longitudinally upon the laminated core thus formed, and they fill the rectangular spaces. They may with advantage be wound in alternate layers, though this may not always be a necessary construction. Against the ends of the series of plates are placed rounded blocks F' and F', of wood or other suitable material, for the purpose of affording curved ends, over which the conductors are wound.

The primary and secondary conductors may with advantage be of equal size and more or less of the convolutions of one coil included in multiple arc with each other, as required, to obtain currents of the required character. The sizes may be varied, however, as found expedient.

After the conductors have been wound in place, short plates G' G', &c., of iron, are placed across the ends of the projecting arms *a' a'*, and these serve to magnetically connect corresponding arms with each other upon each side of the coils, forming complete rings of magnetic material about the coils. The wire is thus completely inclosed by a series of rings of magnetic material. The plates G' G', &c., are insulated from each other magnetically, and preferably also electrically, by washers or plates *d d*, of vulcanized fiber or other suitable material.

In Figs. 3 and 4 a modified form is shown. In this instance, the plates A A, &c., are formed with a curved arm at each end of the web *a*, as shown at *a'* and *a²*. The plates radiate from a common center, and may be conveniently supported upon a block or cylinder, H, which is preferably of wood or other non-magnetic material. The plates are magnetically, and preferably also electrically, separated from each other, in essentially the same manner as described with reference to Figs. 1 and 2, by means of plates *d' d'*. The primary and secondary conductors E' and E' are wound about the core formed by the webs *a*, filling the space between the arms *a' a'* and *a² a²*, and then plates G' G', &c., are placed outside the coils connecting the respective arms *a'* and *a'*.

I claim as my invention—

1. An inductorium or converter consisting of two coils of wire, a core around which successive convolutions of the same are wound, consisting of laminæ of magnetic material extending in a direction at right angles to the direction of the wire of the coils, and a mechanically separate outer laminated shell of magnetic material, the outer laminæ respectively being magnetically connected with the laminæ of the core.

2. An inductorium or converter consisting of a series of thin plates having outwardly-projecting arms, plates connecting the ends of said arms, and conductors within the spaces between said arms.

3. The combination, substantially as herein-before set forth, of a series of double-T-shaped plates of soft iron arranged side by side and magnetically separated, primary and secondary coils wound upon the same longitudinally, and plates of soft iron connecting the outer ends of the arms of the T shaped plates, substantially as described.

4. The combination, substantially as herein-before set forth, of a series of plates of soft iron having two pairs of oppositely-projecting arms, coils of insulated wire wound in the spaces between the arms, and plates connecting the outer ends of the arms, substantially as described.

In testimony whereof I have hereunto subscribed my name this 11th day of February, A. D. 1886.

GEO. WESTINGHOUSE, Jr.

Witnesses:
R. H. WHITTLESEY,
C. M. CLARKE.

290

(No Model.)

W. STANLEY, Jr.

INDUCTION COIL.

No. 349,617. Patented Sept. 21, 1886

Fig. 1.

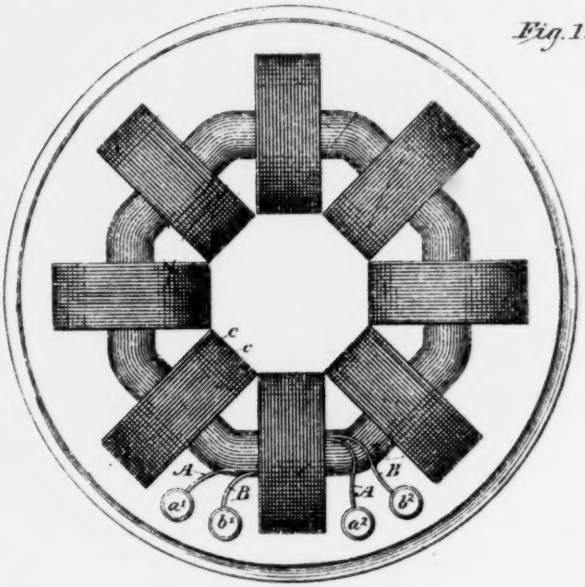
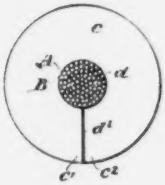


Fig. 2.



Witnesses

Geo. W. Breck

Caroline E. Davidson

Inventor

William Stanley Jr.

By his Attorneys

Pope & Edgecomb

UNITED STATES PATENT OFFICE.

WILLIAM STANLEY, JR., OF GREAT BARRINGTON, MASSACHUSETTS, ASSIGNOR TO GEORGE WESTINGHOUSE, JR., OF PITTSBURG, PA.

INDUCTION-COIL

SPECIFICATION forming part of Letters Patent No. 349,617, dated September 21, 1886.

Application filed February 10, 1886. Serial No. 191,406. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM STANLEY, Jr., a citizen of the United States, residing in Great Barrington, in the county of Berkshire and State of Massachusetts, have invented certain new and useful Improvements in Induction-Coils, of which the following is a specification.

My invention relates to the class of apparatus employed for converting electric energy from currents of a given potential to currents of a different potential or different quantity.

In the conversion of electrical energy from currents of a lower to a higher potential, and vice versa, by means of induction-coils, it is desirable that the quantity of iron acted upon by the currents in the primary circuit, and in turn reacting upon the coils in the secondary circuit, should be as great as possible, and that the iron itself should be divided into thin lamine or plates, rather than united in a solid mass, and it is also desirable that the parts be so organized as to render the construction of the coil as simple as possible.

The object of the invention is, therefore, to provide a form of induction-coil in which the magnetizable portion is formed of thin plates of soft iron adapted to support the primary and secondary conductors in such manner that they shall be as nearly as possible surrounded by magnetic material, and shall be so located that the currents traversing the primary shall be expended to the best advantage in magnetizing the iron, and that the magnetization and demagnetization of the iron shall be utilized to the best advantage in establishing induced currents in the secondary coils.

The invention consists in winding the primary and secondary conductors upon a suitable form, which may with advantage be octagonal, and mounting upon the coil or core of wires thus formed by the primary and secondary conductors annular disks or rings of magnetic material. These disks are applied by being formed with central openings of such size as to receive the wire, and they are cut open upon one side. By springing the two ends thus formed laterally they are slipped over the core of wire, and thus caused to surround the conductors.

In another application of even date herewith, Serial No. 191,405, there is described an inductorium resembling in some of its features that described and claimed herein.

In the accompanying drawings, Figure 1 is a plan view of an induction-coil constructed upon this principle, and Fig. 2 is a cross section of a portion of the same.

Referring to the figures, a' and a^2 represent the terminals of the primary conductor A, and b' and b^2 the terminals of the secondary conductor B. These conductors are wound upon a suitable forming-block into an annulus, which may be of circular, or, as shown in the drawings, of an octagonal form. The ends of the conductors are secured to suitable binding-posts. The conductors having been thus formed, the iron to be acted upon by the primary conductor, and in turn to act upon the secondary coils, is placed in position. It consists of a series of disks, c c, which are separately formed. Each disk has an opening through the center, as shown at d, of such size as to admit the core of wire, and a slot or opening, d', is cut from the center to the periphery. By springing the ends c' and c^2 aside or in opposite directions the disks may be placed, one at a time, upon the coils. They are preferably separated from each other by non-magnetic material, for the purpose of rendering the coil capable of more rapid magnetization and demagnetization.

I claim as my invention—

1. The combination, substantially as herein-before set forth, with the primary and secondary conductors of an induction-coil wound to form an annulus, of a series of slotted plates of soft iron, through which the conductors extend.

2. The combination, substantially as herein-before set forth, of a series of magnetically-separated disks or plates of soft iron, each having a radial slot, and primary and secondary conductors extending axially through the same, substantially as described.

In testimony whereof I have hereunto subscribed my name this 28th day of January, A. D. 1886.

WILLIAM STANLEY, JR.

Witnesses:
DANL. W. EDGECOMB,
CHARLES A. TERRY.

294

No. 19.
Westinghouse
Wagner Co

(No Model.)

W. STANLEY, Jr.

INDUCTION COIL.

No. 349,616. Patented Sept. 21, 1886.

Fig. 1.

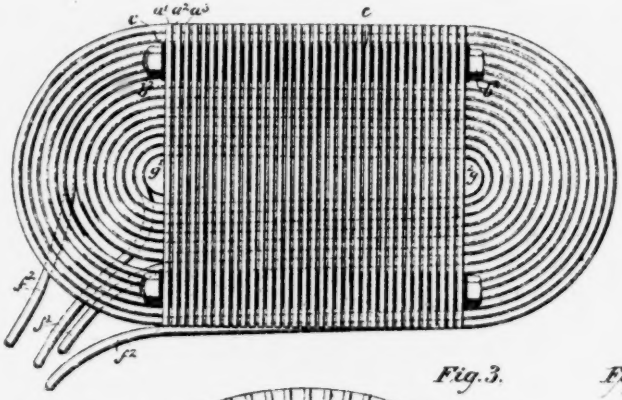


Fig. 2.



Fig. 3.

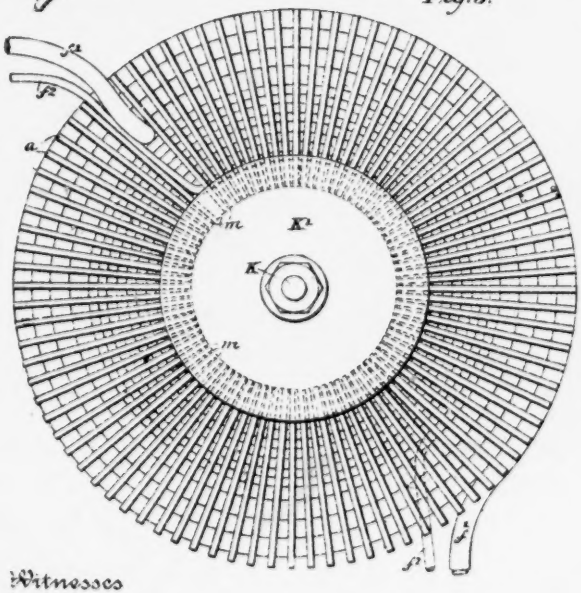
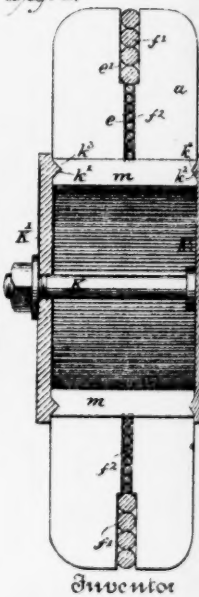


Fig. 4.



Witnesses

Geo. W. Brick

Emma E. Ashley

Inventor

William Stanley Jr.

By his Attorneys

Pope & Edgecomb

UNITED STATES PATENT OFFICE.

WILLIAM STANLEY, JR., OF GREAT BARRINGTON, MASSACHUSETTS, ASSIGNOR TO GEORGE WESTINGHOUSE, JR., OF PITTSBURG, PA.

INDUCTION-COIL.

SPECIFICATION forming part of Letters Patent No. 349,616, dated September 21, 1886.

Application filed February 10, 1886. Serial No. 191,405. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM STANLEY, JR., a citizen of the United States, residing in Great Barrington, in the county of Berkshire and State of Massachusetts, have invented certain new and useful Improvements in Induction-Coils, of which the following is a specification.

The invention relates to the class of electrical apparatus employed for transforming electric currents of a given character into currents of different form.

In the conversion of electrical energy from currents of a lower to a higher potential, and vice versa, by means of induction-coils, it is desirable that the quantity of iron acted upon by the currents in the primary circuit, and in turn reacting upon the coils in the secondary circuit, should be as great as possible, and that the iron itself should be divided into thin laminæ or plates, rather than united in a solid mass, and it is also desirable that the parts be so organized as to render the construction of the coil as simple as possible.

The object of the invention is, therefore, to provide a form of induction-coil in which the magnetizable portion is formed of thin plates of soft iron adapted to support the primary and secondary conductors in such manner that they shall be as nearly as possible surrounded by magnetic material, and shall be so located that the currents traversing the primary shall be expended to the best advantage in magnetizing the iron, and that the magnetization and demagnetization of the iron shall be utilized to the best advantage in establishing induced currents in the secondary coils.

The invention consists in constructing the core of the coil from thin plates of magnetic material, each provided with one or more slots or narrow cuts for receiving the primary and secondary conductors. These plates are bolted together side by side with the openings for receiving the wire in alignment with each other but they are separated from each other by washers or plates of non-magnetic material. The coils of wire are wound in the openings formed in the plates, and are thus bounded upon both sides by soft iron.

In an application of even date herewith, Serial No. 191,406, there is described and claimed an inductorium in which primary and secondary conductors are wound in slots formed in soft-iron plates to form an annulus, and such construction is not, therefore, specifically claimed herein.

In the accompanying drawings, Figure 1 is a side elevation of an induction-coil constructed upon this plan, and Fig. 2 is a transverse section of the same. Figs. 3 and 4 are respectively similar views of a modified form.

Referring to the drawings, a' a^2 a^3, &c., represent a series of plates of soft iron, which are fastened together side by side by bolts b', b^2, b^3, and b^4. These plates are separated by washers c, which intervene between the respective plates and prevent them from coming into contact with each other. The bolts themselves are preferably surrounded by sleeves or tubes of non-conducting material, which prevent them from coming in contact with the plates, and thereby placing them in magnetic connection with each other.

In the form shown in Figs. 1 and 2 each plate is constructed with two narrow slots, e' and e^2, cut from the opposite ends, and when the plates are fastened together the slots e' in all the plates are in alignment, and likewise the slots e^2. Against the ends of the series of plates there are placed blocks g' and g^2, of wood or other suitable material, around which the wire is wound. One of the conductors—say the primary conductor f'—is wound through the slots and occupies about one-half the space in each slot. The secondary conductor f^2 is then applied, being wound in like manner until the slots are entirely filled. It will be apparent that if the wire be of a thickness equal to the width of the slot, then but one line of convolutions will be formed, and each wire will have magnetic material upon opposite sides.

The wire may be less in thickness than the width of the slots, and two or more lines of convolutions of either or both the primary and the secondary conductors may thus be made. On the other hand, the primary and secondary conductors may be of different sizes, so that there will be but one line of convolutions of one conductor and two or more of the other.

296

It is not necessary that the primary conductor should be inside and the secondary conductor outside; but the relative positions may be reversed, and they may be arranged in any well-known manner relatively to each other. Still another modification is to make the outer portion of the slot wider than the inner, as shown in Fig. 4, and to employ in connection therewith any of the methods of winding which have been already mentioned; or a conductor of the width necessary to fill the narrower or inner portion may form one coil, and a thicker conductor filling the outer space be employed as the other conductor.

The form of induction-coil shown in Figs. 3 and 4 differs from that first described, in that each plate consists of one-half the plate shown in Fig. 2, and the series of plates are arranged in the circular form and held in place by two clamping-plates, K′ and K², which are preferably of non-magnetic material. These plates are constructed with annular lugs k' and k^2, which project into corresponding grooves or notches, k^2 and k', formed in the edges of the plates. The inner ends of the plates may with advantage be separated by wedge-shaped blocks *m* and *m*, of non-magnetic material. The plates being arranged in position, the two supporting-plates K′ and K² are secured together by a bolt, K. The wire is then wound circumferentially in the slots or openings e' e' in the same manner as described with reference to Figs. 1 and 2.

I claim as my invention—

1. An induction-coil consisting of a series of plates, each having one or more slots cut therein, and two coils of wire, constituting primary and secondary conductors, wound in said slots.

2. An induction-coil consisting of a primary and a secondary coil, each wound in a single tier of convolutions, and magnetic material upon opposite sides of each series of convolutions.

3. The combination, substantially as herein-before set forth, of a series of plates of soft iron, each having a narrow slot formed therein, means for supporting said plates with the slots in alignment, and primary and secondary conductors wound in said slots, substantially as described.

4. The combination, substantially as herein-before set forth, of a series of plates magnetically separated from each other, an opening or slot formed in each plate, the width of each opening being greater through its outer than through its inner portion, and primary and secondary conductors wound in said slots.

5. The combination, substantially as herein-before set forth, of an annular series of plates, each containing a narrow slot, means for supporting the plates, and primary and secondary conductors wound in said slots and filling the same, substantially as described.

In testimony whereof I have hereunto subscribed my name this 28th day of January, A. D. 1886.

WILLIAM STANLEY, JR.

Witnesses:
DANL. W. EDGECOMB,
CHARLES A. TERRY.

No. 179. Westinghouse Warner

(No Model.)

K. ZIPERNOWSKY, M. DÉRI & O. T. BLATHY.

INDUCTION COIL.

No. 352,105. Patented Nov. 2, 1886.

Fig. 1.

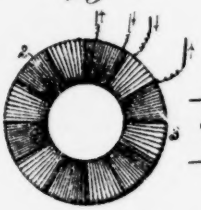


Fig. 2.



Fig. 5.

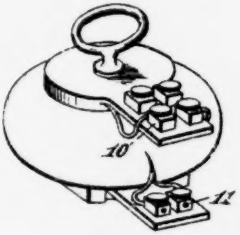


Fig. 3.



Fig. 4.

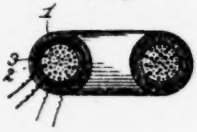


Fig. 6.

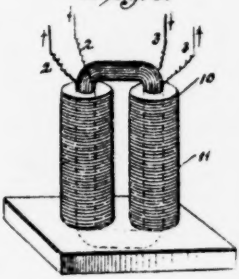


Fig. 7.

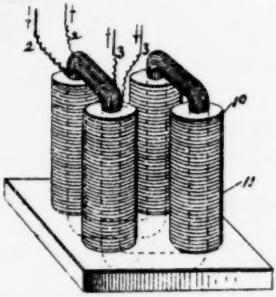
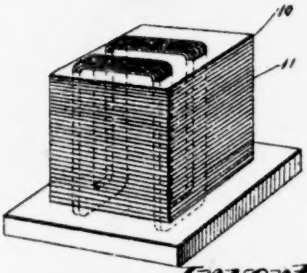


Fig. 8.



Witnesses.
Robt Everett
Geo. W. Rea

Inventors.
Karl Zipernowsky
Maximilian Déri
Otto Titus Blathy
By
Van Santvoord & Hauff
Atty

UNITED STATES PATENT OFFICE.

KARL ZIPERNOWSKY, OF BUDA-PESTH, MAXIMILIAN DÉRI, OF VIENNA, AND OTTO TITUS BLÁTHY, OF BUDA-PESTH, AUSTRIA-HUNGARY.

INDUCTION-COIL.

SPECIFICATION forming part of Letters Patent No. 352,105, dated November 2, 1886.

Application filed May 7, 1885. Serial No. 164,692. (No model.) Patented in Austria-Hungary March 2, 1885; in France April 21, 1885, No. 168,417; in Belgium April 21, 1885, No. 68,583; in England April 27, 1885, No. 5,201, and in Italy June 30, 1885, XXXVI, 154.

To all whom it may concern:

Be it known that we, KARL ZIPERNOWSKY, residing at Buda Pesth, MAXIMILIAN DÉRI, residing at Vienna, and OTTO TITUS BLÁTHY, residing at Buda-Pesth, Austria-Hungary, subjects of the Emperor of Austria and King of Hungary, have invented new and useful Improvements in Induction Apparatus for Transforming Electric Currents, of which the following is a specification.

The object of the present invention is to solve the problem of distributing electrical energy in a practical and at the same time economical manner, and we attain this by inductional transformers for alternate currents with closed magnetic circuit.

Before entering into a description of our invention, we may premise that for the illumination of towns, as also generally in the case of the electric current requiring to be distributed over long distances, the so called "secondary inductors" or "transformers" are specially adapted, as it is possible, by the aid of this apparatus, to distribute the current in a cheap and satisfactory manner over great, almost unlimited, distances. The conversion of currents of low tension into currents of high tension has been effected for years by means of Ruhmkorff's coil; but for general lighting purposes the use of currents of high tension is not desirable, and electricians have for a considerable time occupied themselves with the solution of the reverse problem. Another form of secondary generator recently brought into use has been found defective, for the reason that while a conversion of the currents take place the suppression of the iron core, that active agent in induction, is a decided retrograde step, since it has been found that the most appropriate means of considerably increasing the yield of secondary generators or transformers is to increase as much as possible the action of the iron in the apparatus, which is an incontestable fact, evidenced by the development of the dynamo-machine.

The inductional transformer devised by us differs in its outward form, as well as in its internal arrangement, from others heretofore known, and its advantages are greater yield and useful effect with the greatest possible simplicity and durability. These advantages we attain by increasing their inductive action as much as possible and removing all the possible causes of the loss of energy which operate during the conversion of electric currents; and since our transformer possesses the greatest yielding capacity it offers the greatest advantages with regard to the useful effect to be attained. Particularly is this due to the fact that our transformer is constructed in such a way as to prevent any dispersion of the lines of magnetic force, and as to place all the turns of the coils through which the currents flow, as it were, in a homogeneous magnetic field. This will cause the action of the induction to be the same on each particle of the copper wire, and the chief cause of the loss of energy—the Foucault currents—will be prevented.

The invention consists in an inductional transformer having an iron core, in which the lines of magnetic force can circulate without generating free magnetic poles, the core being made up of small sections insulated from one another parallel to the lines of force, in order to prevent the circulation of the objectionable Foucault currents, which would tend to flow in planes perpendicular to the lines of magnetic force were a core piece of non-insulated sections employed. The primary and secondary coils are wound on the insulated iron core-piece in such a way, or are disposed thereon or relatively arranged thereto in such a manner, that every individual winding or turn of the secondary coil has the same electro-motive force, this being due to the fact that all windings inclose the same number of lines of magnetic force within the space or area covered by them on the core-piece. By connecting an alternating-current dynamo-electric machine with the primary coil the current from the former excites magnetism in the iron core, the direction of which magnetism alternates in rapid succession, and thus an alternating secondary induced current is excited in the secondary coil of the apparatus, this current passing off into a proper circuit and being utilized in any convenient way. It is to be observed that the iron in the transformer

(Here follows diagram marked p. 298.)

serves only as a medium for conveying the lines of force and not as a conductor for electric currents. ✱

Figure 1 is a plan view of a transformer having a core formed of iron wire and surrounded by the primary and secondary coils of copper wire. Fig. 2 is a vertical section taken through Fig. 1. Figs. 3 and 4 show a reversed position of the copper and iron wires, the latter surrounding a core of insulated copper wire. Fig. 5 is a perspective view of a complete transformer made according to Figs. 3 and 4, and showing the connections and supports for the terminal and line wires. Figs. 6, 7, and 8 are different modifications of the transformer, in which the same fundamental principle obtains—that is to say, that the copper conductors are completely surrounded by iron, and that the latter is so arranged that the lines of force form circles in planes which are perpendicular to the copper conductors.

In the construction shown in Figs. 1 and 2, a ring or hoop shaped iron core (designated by the reference numeral 1) is composed of iron wires or circular sheets, varnished or otherwise insulated to prevent the circulation of the so-called "Foucault currents." Upon the iron core thus formed are wound insulated copper wires, constituting the primary and secondary coils, 2 and 3, of the apparatus. As shown in Fig. 1, the whole surface of the iron ring or hoop is covered with copper wires, the primary and secondary coils being disposed in alternate segmental sections. This mode of winding, however, is not essential, since the wires can be arranged in separate superposed layers, with the primary and secondary terminals connected, respectively, with the source of electric energy—viz., an alternating-current dynamo-machine—and the distributing circuit or the apparatus where the secondary currents are to be utilized, copper wires constituting the primary and secondary coils, 2 and 3, of the apparatus. The terminals of these coils (marked 2 and 3) are connected, respectively, with an alternating-current dynamo-machine, or other source of high-tension electricity, and the apparatus where the secondary or inducted currents are to be utilized.

In the construction shown in Figs. 3, 4, and 5, the iron and copper have changed places, the core in this instance consisting of insulated copper wires, which form primary and secondary coils, and are formed into a ring of a circular or other form in cross-section. The copper-wire core thus formed is provided with an insulating covering consisting of linen soaked in varnish, and is finally wound closely with thin iron wires, the windings of which are insulated from each other by a varnish-coating of the wires or by any other appropriate insulating medium.

In the construction shown in Figs. 3, 4, and 5 it will be seen that the primary and secondary coils are inclosed or surrounded by what may be termed an "exterior core," made of iron wire or strips properly insulated from each other parallel to the lines of force, and therefore, as in the construction seen in the other figures, the circulation of Foucault currents, and consequent heating of the apparatus, is prevented, and this source of the loss of the electrical energy in other induction devices is thus effectually removed. As seen in Fig. 5, the insulated iron wires form a complete covering for the primary and secondary coils, and the terminals of the latter pass through a gap in said covering or exterior iron core, and are connected with suitable binding-posts, 10 and 11.

It is apparent that in the above-described devices the directions of the lines of force in the iron not only suffer no interruption, but always form the shortest lines, and hence an active circulation will take place, first in one and then in the opposite sense, in accordance with the change of the direction of the inducing current in the copper wires. This is due to the fact that each particle of the copper conductor is surrounded by an equal number of iron wires, and consequently, also, by an equal number of lines of force—that is to say, if the distribution is to be regarded with respect to space and not to cross-section. The extremely powerful action of such transformers is apparent; also, that they present a perfect system of equilibrium for the electrical and magnetic reversing action, and that the transformation is effected with great simplicity and regularity by the induction brought into action by comparatively small masses.

In place of insulated iron wires constituting a core, as in Fig. 1, or such wires being wound around copper wires, as in Figs. 3 and 4, we may use iron plates 10, which are superposed upon each other like the elements of a dry voltaic pile, sheets 11 of insulating material being placed between the iron plates. Into a hole formed in the middle of the column of plates thus formed, are introduced the insulated copper wires which are conducted through both columns and have their terminals suitably arranged for the reception and distribution of electrical energy.

In Fig. 6 two columns, formed of iron plates, are shown, whereas in Fig. 7 four such columns are represented. It should be observed that the number of columns may be increased; but in all instances the direction of the flow of current through two contiguous or touching columns is in an opposite direction. It is also to be observed that instead of making the columns shown in Figs. 6 and 7 of iron plates, the copper core when of an oblong shape has only the straight parts of it inclosed by insulated iron wires, these wires being wound spirally or otherwise on the copper core.

In the construction shown in Fig. 8, iron plates 10, of any preferred shape, are employed, these plates being provided with holes in several places, so that when the parts are piled upon each other these holes will register and form continuous passages throughout the entire height of the column of plates. Strips 11

of insulating material are interposed between such pair of plates, and through the holes formed therein the copper wires are conducted back and forth in such a way that the current in two parallel neighboring branches of the wire must flow in opposite directions. The inductive effect of such a column of plates is the same upon each branch of the wires, and for this reason the united effects give a very high result. It is to be stated that instead of placing insulating-sheets between the plates constituting the columns, we may cover the plates themselves with an insulating material—such as varnish, &c.

While we have shown several preferred constructions as the most efficient embodiment of our invention we wish it to be understood that other modifications will readily suggest themselves. For example, the number of plates in the columnar form of apparatus may be varied and likewise the manner of winding the various wires may be changed. Furthermore, instead of using copper wires for conducting the currents, we can make use of bars or tubes for a like purpose.

We are aware that Faraday in his experimental researches made use of a welded ring of soft round iron of small diameter and partly wrapped the same with wire constituting the primary and secondary coils of an induction apparatus. In such arrangement there exists an iron core closed upon itself for causing the lines of magnetic force to circulate entirely within it; but it cannot constitute an efficient inductorium and is not adapted for the purposes for which our transformer is designed, since the massive or homogeneous iron ring allows the so-called "Foucault currents" to freely circulate, and the latter are made to consume the greater part of the energy furnished by the electric current, and will in a very brief space of time cause the destruction of the apparatus by their heating action upon the same.

What we claim as our invention is—

1. An inductional transformer consisting of primary and secondary conductors wound or extending continuously in the same direction and having free terminals and an iron core or body closed upon itself and around said conductors, the core or body being formed of sections insulated from each other parallel to the lines of magnetic force, substantially as herein set forth.

2. An inductional transformer consisting of a closed hoop or ring shaped iron core made of sections insulated from each other parallel to the lines of force and primary and secondary helices wound uniformly and continuously in the same direction on the core and having free terminals, substantially as herein set forth.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

KARL ZIPERNOWSKY.
MAXIMILIAN DÉRI.
OTTO TITUS BLÁTHY.

Witnesses:
JOSEF HAMON,
HENRY STERNE.

No. 179. Westinghouse Elec. & Mfg. Co.

(No Model.) 3 Sheets—Sheet 3.

E. THOMSON.

SYSTEM OF ELECTRIC DISTRIBUTION.

No. 360,122. Patented Mar. 29, 1887.

Fig. 16.

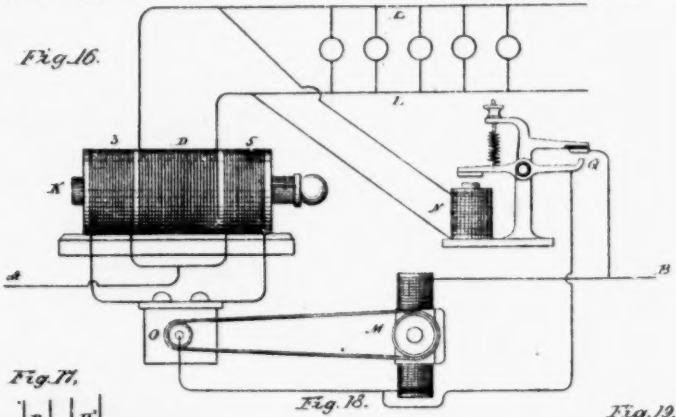


Fig. 17.

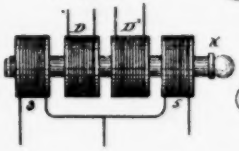


Fig. 18.

Fig. 19.

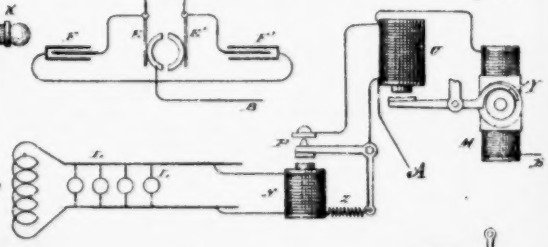


Fig. 20.

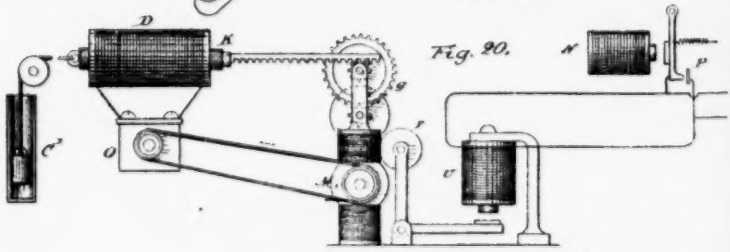
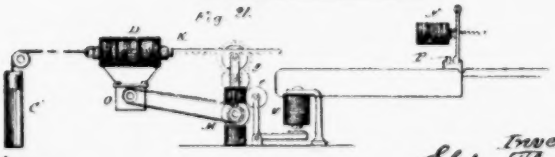


Fig. 21.



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Westinghouse Co. vs. Wagner Co. 306

(No Model.) 3 Sheets—Sheet 2

E. THOMSON.

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No. 360,122. Patented Mar. 29, 1887.

Fig. 7.

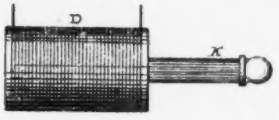


Fig. 8.

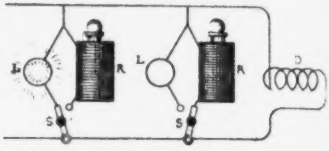


Fig. 9.

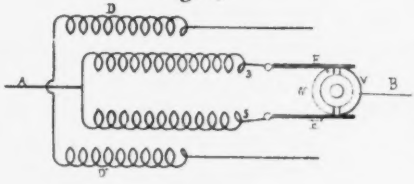


Fig. 10.

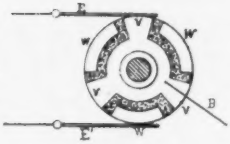


Fig. 11.

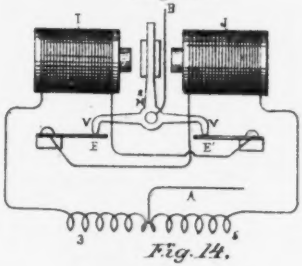


Fig. 12.

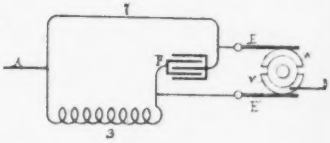


Fig. 13.

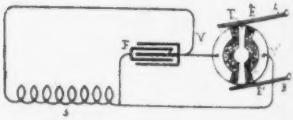
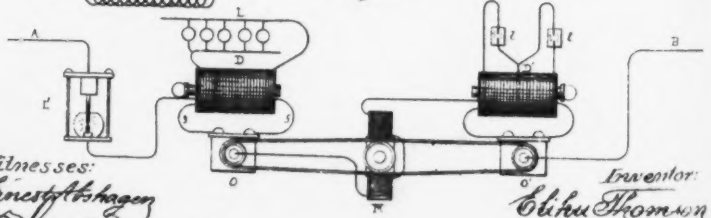


Fig. 14.



Fig. 15.



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308

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Westinghouse } No. 308.
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(No Model.) 3 Sheets—Sheet 1.

E. THOMSON.

SYSTEM OF ELECTRIC DISTRIBUTION.

No. 360,122. Patented Mar. 29, 1887.

Fig. 1.

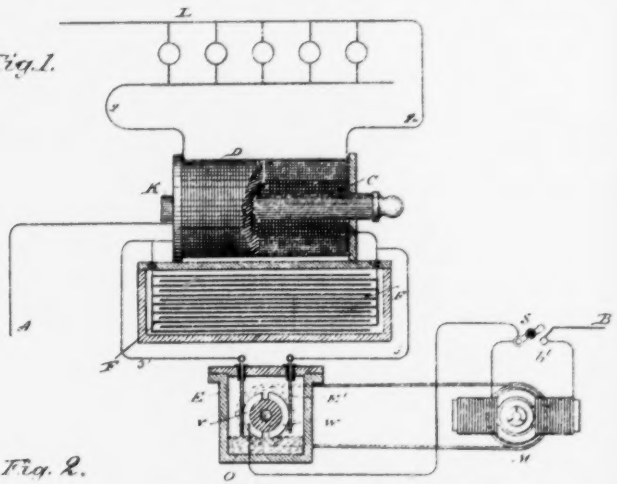


Fig. 2.

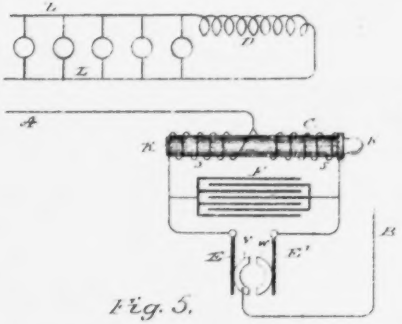


Fig. 3.

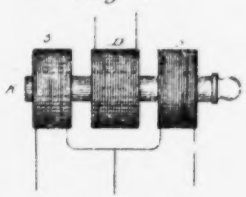


Fig. 4.



Fig. 5.

Fig. 6.

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UNITED STATES PATENT OFFICE.

ELIHU THOMSON, OF LYNN, MASSACHUSETTS, ASSIGNOR TO THE THOMSON-HOUSTON ELECTRIC COMPANY OF CONNECTICUT.

SYSTEM OF ELECTRIC DISTRIBUTION.

SPECIFICATION forming part of Letters Patent No. 360,122, dated March 29, 1887.

Application filed May 21, 1884. Serial No. 132,249. (No model.)

To all whom it may concern:

Be it known that I, ELIHU THOMSON, a citizen of the United States, and a resident of Lynn, in the county of Essex and State of Massachusetts, have invented certain new and useful Improvements in Systems of and Apparatus for Electric Distribution, of which the following is a specification.

The object of the present invention is to provide a means whereby a main electric circuit conveying a continuous and constant, or approximately constant, current may be made to supply a local line or circuit entirely independent of any electric contact or connection between the main and local circuits, and without interruption or disturbance of current in the main circuit, whereby arc lights, electric motors, or other electrical apparatus may be used or operated on the main circuit by current supplied from any source connected with said circuit, while upon the local or independent circuits incandescent electric lights or other electric apparatus may be used or operated with a current either of the same or different potential from that flowing upon the main circuit.

My invention is especially designed for the purpose of operating electric-arc lamps and incandescent lamps from the same current source, but in such way as to avoid the danger in the incandescent circuit or circuits of shocks and grounds that would affect the operation of the arc lights.

My invention consists in the combination, with a continuous line-circuit and continuous current-supply in said circuit, of one or more induction-coils and commutating devices adapted to change, shift, or modify the current in the primary coil or coils for the purpose of setting up currents in the secondary coil without rupturing the line-circuit supplying the primary, and without disturbing the flow of current in said line-circuit through arc lamps or other apparatus located upon other portions of the same.

My invention consists, also, in regulating the action of the induction-coil for the purpose of adjusting the current set up in the secondary circuit by means of an electro-magnet, or other device responsive to electric currents, connected with the secondary of said induction-coil. Said magnet or other device is the controlling-magnet, and is arranged to act directly or indirectly upon some mechanism whereby the strength or intensity of the currents given off by the secondary coil of an induction-coil may be adjusted or varied. Among the devices that will suggest themselves to those skilled in the art as applicable for this purpose are a movable or adjustable core for the induction-coil, an adjustable secondary coil, and mechanism whereby the speed of the commutator for the primary may be varied, &c. I do not limit myself, however, as to the particular regulating device or mechanism, but design employing any that will effect such purpose, the gist of my invention consisting in governing the action of such mechanism by a magnet or other device connected with the secondary of the induction-coil.

My invention consists, also, in certain details of construction and combinations of devices, that will be hereinafter described, and then specifically stated in the claims.

In the accompanying drawings, Figure 1 illustrates diagrammatically an arrangement of induction-coil commutator and circuits for carrying out my invention. Fig. 2 is a diagram showing the secondary and primary coils separated. Fig. 3 illustrates a modified arrangement of the primary where a primary coil in two divisions is employed. Fig. 4 is an end view of the induction-coils shown in Fig. 3. Figs. 5 and 6 illustrate arrangements of switches employed for adapting the electro-motive force of the secondary current to the requirements. Fig. 7 is a side view of an induction-coil, illustrating an adjustable core. Fig. 8 is a diagram illustrating a means whereby lights may be cut out in such manner as not to affect each other's brilliancy. Fig. 9 illustrates diagrammatically a modified arrangement of primary and secondary coils. Fig. 10 is a side view of a modified form of commutator. Fig. 11 shows a vibrating or reciprocating commutator adapted for use with a primary coil having two divisions, into which divisions the current is shifted consecutively. Fig. 12 shows an arrangement in which one of the divisions of the primary is dispensed with.

Figs. 13 and 14 show other constructions of commutator that may be employed in carrying out my invention. Fig. 15 is a diagram illustrating one of the applications of my invention. Fig. 16 illustrates diagrammatically a means of keeping the electro-motive force of the secondary constant despite fluctuations in the main-line current. Fig. 17 illustrates a modified arrangement of the primary and secondary coils. Fig. 18 shows a modified arrangement of condenser as used with the induction-coil. Figs. 19, 20, and 21 show arrangements of devices whereby the electromotive force on the secondary may be regulated according to my invention.

Referring to Fig. 1, A B indicates a portion of a circuit upon which a continuous or constant current from any source flows.

C D indicate, respectively, the primary and secondary coils of an inductorium or induction-coil provided, as usual, with an iron core, K, consisting of a bundle of iron wire or sheets of iron, all constructed in any desired manner. Said core is made adjustable within the coil, by preference, so as to permit the electro-motive force of the secondary currents to be regulated either by hand or automatically by the means to be hereinafter described.

One or more secondary coils, as well as one or more primary coils, may be used, as is obvious, upon the same core. A single primary and single commutator therefor may be employed, if desired; but I prefer in general to use a primary divided into two or more sections, and to change the current from one section to the other in succession.

In Figs. 1 and 2 I have illustrated a primary coil made in two divisions and combined with a single commutator, as will be presently described. The terminals 2 2 of the secondary coil, which latter is made of wire of any gage suited to the needs of current and electro-motive force to be taken from it, are carried to the circuit containing electric lights or other apparatus, L L, which latter are here indicated as incandescent lights arranged in multiple arc. The two portions of the primary are indicated in Fig. 2 at 3 5, where the main conductor A is shown as branching through said coils in order to reach its continuation at B. As indicated, current entering at A would pass oppositely in the two halves of the primary coil, in order to reach the brushes E E' of a commutator, to which the ends of said coils are respectively connected.

The two portions 3 5 may be superposed, interwound, or may occupy different longitudinal positions over the core.

In a bridge, between the two terminals of the induction-coil, is a condenser, F, of ample size to condense any extra currents engendered in the primary coil. The commutator shown in this figure is a revolving commutator, upon whose cylindrical surface the brushes E E' bear, and consists of a conducting segment, V, which is in constant connection with the main conductor B, and a segment, W, which is insulated from the segment V. The brushes E E' have sufficient bearing upon the cylinder, so that the segment V shall be always in contact with one or the other of them, and a constant circuit shall be thus provided for the current upon the line A B. Constant connection with the segment V may be maintained by any suitable means—as, for instance, by the device (well known in the art) of a continuous ring mounted upon the same shaft with V and electrically connected with it, and a brush bearing on the ring and connected with the wire B.

The commutator may be revolved by any suitable device, as by clock-work or by gearing connecting it with any source of power. I find, however, that a small electric motor driven by the electric current supplied through conductor A B is much to be preferred. Such an electric motor is indicated at M, with its coils in the circuit A B and operatively connected with the commutator by a belt. A switch, S, serves to shunt the motor M to stop its action. When the switch is turned to the position shown in the drawings, the current on the circuit A B flows through the motor; but when the switch is turned to make contact with the button *b'* the current passes around said motor, bringing it to a stop.

Though not essential to the operation, I find it far preferable to run the commutator in such way that it may have a constant lubrication by mineral oil. It is here shown as running in a closed oil-case, in which is a quantity of oil (indicated at O) sufficient in amount to permit the commutator to run just in contact with the oil surface.

I wish it distinctly understood that I may modify the mode of oiling indefinitely, and that, however the parts are disposed to that end, the continuous oiling is a feature of such a commutator for induction apparatus, as it greatly enhances the uniformity of delivery of current in the secondary circuits. The movement of the commutator effects such oiling in obvious way. A stream of oil might be allowed to run upon it, or wings or blades made to scatter oil in the case so as to splash upon the commutator.

Having now described the typical elements of my invention, I will proceed to describe their operation, and afterward to point out some of the modifications of more or less desirability that may be made without departing from the spirit of the invention.

By the revolution of the commutator, driven at a high rate of speed by the electric-motor mechanism M, connection is alternately made from brushes E E' to conductor B through the conducting segment V without interruption of circuit. There results from this a passage of current at one instant of time from A through primary coil-section 3 to E and to B, and at the next instant from A through primary coil-section 5, brush E', and to B; but as coils 3 and 5 are reversely wound, so as to magnetize

the core K oppositely, there will be reversals of magnetism in K corresponding in number with the number of changes of current in 3 and 5. These reversals develop current in the secondary D, which current finds circuit through the lamps L or other apparatus. The condenser F enhances the effects by absorbing and discharging the extra currents developed in the primaries at the instant of rupture of the segment V with brushes E E'. The lubrication furnished by the body of oil O gives great definiteness to the makes and breaks and secures a uniform discharge in the secondary. Copious lubrication is needed, as mere ordinary oiling does not enhance the effects to any appreciable degree.

In Fig. 3 the coils 3 5 are placed to either side of the secondary coil D. This arrangement conduces to effective insulation between them. It is desirable to suspend both sets of coils in free air, so that they shall be separated from each other and from the core K by a clear air-space all around. This plan should be adopted where the main-line current is of very high potential—say three thousand volts or over. The coils may be suspended in any desired manner, suitable provision being made for insulation.

In Fig. 5 I have indicated a secondary coil divided into three sets or sections, D D' D', the terminals of which sections are connected to the plates *a a' b b' c c'* of an electric switch having plug or socket holes between the several plates adapted for the insertion of connecting metallic plugs. By connecting the plates as shown in Fig. 5 the secondary coils may be thrown into series to obtain increased tension; or by connecting them as shown in Fig. 6 they may be placed in multiple arc for quantity effect; or by other arrangements of the plug they may be placed in multiple arc and series, so as to adapt the electro-motive force to the demands of the apparatus supplied with secondary current. For the same ends the core of the coil D may be partially or entirely withdrawn, as indicated in Fig. 7. To regulate the effects, the primaries may be fixed or may move with the cores K; or the secondary alone may be the movable portion. All these variations, being well known in the art, have not been herein illustrated.

Ordinarily the removal of a light or lights or other apparatus connected with the secondary would demand a readjustment of the speed of the commutator or of the relation of the coils and core, in order to prevent undue flow of current to the remaining lamps. To obviate this, a small reactive coil of low resistance wound upon an iron core, as indicated at R, Fig. 8, may be employed and combined with a suitable switch, whereby upon the cutting out of the lamp said coil may be made to take its place. I mean by a "reactive coil" a coil whose opposition to the passage of alternating currents through it is due simply to its counter electro-motive tendency and not to its resistance. The coils R R of Fig. 8 are of this nature, and since the secondary currents are alternating in character the substitution of one for a light extinguished leaves the relation of the electro-motive forces to the remaining lamps constant, so that they do not change their brilliancy. The employment of a reactive coil in this manner forms the subject of claims in another application for patent filed by me March 19, 1883, and I do not therefore claim the same, broadly, herein.

In Fig. 9 two secondary coils, D D', are indicated as in inductive relation to the two primaries 3 5. The primaries may be wound on separate cores or the same core, and the secondaries may be employed separately or together for working local lines. In the modified form of commutator, Fig. 10, three conducting segments or blocks V are provided, and three corresponding insulating segments, W W W. The segments V are in constant connection with conductor B, as before, and the proportions are such that one or the other of the brushes E E' shall be at any time in contact with one or the other of the segments V. A vibrating commutator, which may be substituted for the rotary commutator shown in the preceding figures under some conditions, is illustrated in Fig. 11.

The vibrating lever M' carries at opposite sides of its pivot contacts V, and is provided with an armature by which it may be moved first in one direction and then in the other by the electro-magnets I J, which are in the circuits, respectively, from the terminals of the primary coils 3 5 to the contact-springs E E'. The lever and the contacts V V are connected with the wire B. When the lever is set into vibration, the contacts V V will alternately open contact with the springs E E'. Thus current from A passing through electro-magnet I to E', V, and B, will energize said magnet and pull the armature-lever M' over, so as to break contact with spring E' and make firm contact with spring E. By the latter contact circuit is made through 5, J, E, and to B, so that the armature-lever will now be pulled in the opposite direction, thus opening contact at E and again making contact at E', so as to cause a repetition of the operation. Coils 3 and 5 are the primaries; but I and J might be used as such, and their cores be still made to act on the vibrating armature or armatures carried by the lever M'. One of the sections of primary coil may be dispensed with and its place taken by a simple short conducting-wire, 7, as indicated in Fig. 12, in which case all inductive actions in the arrangements hereinbefore described may be obtained from interruptions in the remaining primary, 3, alone.

If desired, instead of connecting the terminals of the primaries to brushes E E', they may be connected to the two conducting-segments V V' of a revolving commutator, as indicated in Fig. 13, constant connection with said segment being preserved by any desired means. In this case the circuit terminals A B would be connected with the brushes E E', as in-

dicated. The segments V V may each extend over about one hundred and twenty degrees of the circumference of the commutator-cylinder. A short-circuiting piece, T, revolving with the commutator and beneath the brushes, serves to connect the two portions A B of the circuit, while both segments V V' are out of contact with the brushes. During revolution the current from the circuit A B is reversed through coil 3 and short-circuited through T alternately. A simple pair of half-circles might be substituted for the segments V V', as shown in Fig. 14. The effects are, however, not so constant with this construction, being more dependent on the wear of the commutator and springs.

In Fig. 15 I have illustrated a pair of induction apparatus as operating upon the same main line A B, upon which latter are lamps—such as L'—are operated. The commutators of the two apparatus are worked from the same electric motor M. The secondary coil D' is shown as supplying electric arc lamps at I. The secondary coil D supplies incandescent lamps L.

One arrangement of apparatus that may be used for regulating the action of the inductorium by the controlling agency of a magnet or other device connected with the secondary coil is shown in Fig. 16. This arrangement is valuable, especially where the main-line current is subject to fluctuations of volume that would affect the electro-motive force of the secondary current. It is also useful in permitting extinguishment of lights or the throwing out of other apparatus on the secondary circuit.

N indicates an electro-magnet placed in a high-resistance circuit from the terminals of the secondary coil—that is, in parallel arc with the lights or other apparatus, L L—although it may be placed in any other desired electrical connection with the secondary without departing from the invention. This magnet is the controlling-magnet, and by its agency the speed of the commutator for the primary is controlled. This may be effected by controlling the speed of the driving electric motor M, and the latter object may be secured in any of the well known ways, as by shunting current from a part or a whole of the electric motor, by shunting a part or the whole of its coils, or by open circuiting them, or in any other equivalent electrical way. In the present case the electro-magnet N is supposed to short-circuit the whole motor by means of contacts *q*, which are closed when the strength of the magnet reaches a predetermined degree. The strength of current required to effect short-circuiting is determined by any desired adjustment—as, for instance, by the adjustment of a retracting spring acting upon the armature-lever of the ~~magnet N in opposition to~~ said magnet. The speed of the motor M is thus made directly dependent upon the difference of electro-motive force between the terminals of the secondary. The said electro-motive force will obviously vary with the rapidity of the reversals or changes in the primary, other things being equal, and, conversely, the shunting or otherwise lowering of the speed of the motor will diminish the effect in the secondary.

The electro-magnet N may be of any desired form, and may, if desired, be constructed to have a uniform pull upon its core or armature in all positions of the latter with the same strength of current.

In the modified arrangement of primary and secondary coils shown in Fig. 17 separate secondaries, D D', are shown as placed between two primaries, 3 5. In Fig. 18 the condenser is shown as made up of two separate condensers, F F', one foil or set of foils in each being connected to the terminal B, and the other foil or sets of foils connected, respectively, to E and E'.

Fig. 19 shows another arrangement of devices that may be employed for automatically regulating the action of the induction-coil by automatically varying the speed of the commutator. In this case the magnet N, when it acquires a predetermined power, serves to bring into action a brake, which decreases the speed of the driving-motor for the commutator. The motor is in the present instance shown as an electric motor, M, but might be any other form or construction of motor.

The brake is applied by an electro-magnet, U, which may be in the circuit A B, as indicated, with the motor, or may be energized from any desired source. The armature-lever of the electro-magnet U applies a brake shoe, Y, carried by said lever, to the electric motor in obvious ways. The electro-magnet N brings the magnet U into action by opening the contacts indicated at P, which latter normally close a shunt-circuit around the electro-magnet U, so as to normally keep the latter out of action. When the electro-motive force of the secondary D is excessive, the contacts at P are opened by the electro-magnet N and the brake Y slows the motor. Mechanical devices might be substituted for the electro-magnetic brake if properly arranged, to be controlled and applied upon an increase in the power of the electro-magnet N. By the arrangement shown in Fig. 20 an automatic regulation of the action of the induction apparatus may be obtained by shifting the core of the induction-coil. Core K is moved or adjusted in opposite directions by a weight, C', connected with one end of the core, and moving, preferably, in a dash-pot, and by a wheel, *g*, carrying a pinion that engages with a rack attached to the opposite end of the core, or connected with said core in any other suitable manner. The wheel *g* is driven by a second wheel and pinion, which latter are automatically geared to ~~the electric motor~~ M or to any other driving mechanism by means of a shifting-wheel, *r*, which is mounted on a movable support, and may be brought simultaneously into gear with the motor and with the wheel connected to *g*.

The wheel or roller *r* is here shown as mounted upon a lever carrying the armature for the electro-magnet U, the action of the latter being controlled by a magnet, N, in substantially the same manner as the magnet U of Fig. 19. When the roller *r* is geared with the motor M and the driving wheel or wheels *g*, the core K will be withdrawn from the coil D against the action of the weight C', and a diminution in the electro-motive force of the secondary current will result. When the power of the magnet *N* reaches or is restored to its normal, so as to complete the shunt for magnet U, and thus permit the roller *r* to be disengaged by a suitable retractor, the weight C' will draw back the core into its proper place. The same effects may be obtained, also, by reversing the functions of the parts, as indicated in Fig. 21. Here the weight C' is arranged to pull the core K out of the coil D, and the gearing *g* is arranged to pull it into place in said coil. The magnet U is shunted by the contacts P, when the current in the magnet *N* increases, owing to the too great electro-motive force of the secondary D. At this moment the gearing is disconnected from the motor M by the falling away of the roller *r*, and the weight C' begins to draw the core out of the coil. The renewal of the power of U, owing to the diminution in the power of N, and the opening of the shunt-contacts P by the retractor for N, restrains such action by the putting of roller *r* into place to connect the motor M and wheel *g*, this action occurring when the electro-motive force of the secondary has fallen to normal. By either of the devices, Figs. 20 and 21, a balance is soon effected between the position of the core K and the strength of the magnet N, dependent on the electro-motive force of the secondary D. Other means may be employed for determining the action of the secondary coil or inductorium, provided they be arranged to be controlled in position or action by the agency of the magnet N, or other device energized by the currents set up in the secondary coil. I have shown but a few of the forms of commutator that may be employed in carrying out my invention. Others may be used without departing from the spirit of the invention, the object being in any case to produce the changes in the primary coil or coils required for producing induced currents in the secondary by an apparatus without causing any change, reversal, or interruption of the general circuit, excepting in those portions thereof containing the secondary coil or coils, so that a continuous or uninterrupted flow of current may be maintained through any apparatus upon the same general circuit with the primary coils, and other devices may be energized or operated by said current without interference from the action of the commutator in setting up currents for running lamps or other devices by the secondary currents of the induction-coil.

I am aware that it is not broadly new to utilize for operating electric lamps or other translating devices a secondary current generated by changes in the primary through the medium of a circuit shifte. or commutator; but I am not aware that any one has yet devised the system and apparatus described in the foregoing specification, and more particularly set forth in the claims.

The specific features of my inductorium are not claimed in this application; but I reserve the right to claim them in a future application.

The novel electric-lighting system herein described and comprising arc and incandescent lamps placed, respectively, in series on the main line and on a local circuit inductively, united with the main by the induction coil, is not herein claimed, being made the subject of a separate application for patent filed by me. Likewise the mounting of the coils so as to be surrounded by free air space, and the combination, with the secondary coils, of a switch for uniting said coils in series or in multiple arc, or in series multiple arc, are not claimed herein, but in the separate application referred to.

What I claim as my invention is—

1. The combination, with a main line conveying an electric current, of an induction coil having a compound primary, a current-transferring commutator for said primary, and a condenser attached to the ends of the compound primary leading to the commutator.

2. The combination, with an induction coil having its primary divided into two portions, of a source of electric current, a commutator connected to the two portions in the manner described, so as to permit the current to pass oppositely in the two portions of the coil in turn, and a secondary coil exposed to the inductive action of both portions of the primary.

3. The combination, with the main-line circuit, of the induction-coil, a commutator connected with the main line and primary, an electric motor connected to the main line for operating the commutator, and a shunting-switch for closing a main-line circuit around the motor, whereby the latter may be put out of action.

4. In combination with an induction-coil, a local line connected with its secondary, and containing translating devices, and reactive coils having switches, whereby reactive coils may be substituted for lamps extinguished.

5. The combination, with an induction-coil, of a governing-magnet for controlling the action of said induction-coil, said controlling-magnet being connected to the secondary circuit of the induction-coil, as and for the purpose described.

6. The combination, with a line-circuit, of one or more induction-coils, translating devices connected with the secondaries of said induction-coils, and governing-magnets for controlling the action of said induction-coils, said magnets being connected with the secondaries of said induction-coils.

7. The combination, with the current-controlling devices for the primary of the induc

240

tion-coil, of a governing-magnet actuated by a current from a secondary coil, whereby when the electro-motive tendency of said secondary increases said governing-magnet may be brought into action to lessen the rate of distribution of current to the primary coils, and thereby lessen the effect in the secondary.

8. A motor controlling the switch devices or commutator of the primary of an inductorium, in combination with a controlling-magnet in a branch from the secondary and intermediate mechanism, substantially as described, whereby the said controlling-magnet lessens the effect of said motor upon increase of said maguet's power.

9. The combination, with an induction-coil, of a commutator, an electro-magnetic actuating device therefor, a speed-controller for the latter, and a governing electro-magnet or other suitable device responding to changes in a circuit taken from the secondary of the induction-coil.

10. In a system of electrical distribution, an inductorium, an electro-maguet in the secondary circuit thereof, and mechanism controlled by the said magnet for shifting the core of the inductorium, substantially as and for the purpose set forth.

Signed at Lynn, in the county of Essex and State of Massachusetts, this 15th day of May, A. D. 1884.

ELIHU THOMSON.

Witnesses:
E. W. RICE, Jr.,
E. B. DOERR.

316

(No Model.)

W. STANLEY, Jr.

INDUCTION COIL.

No. 349,612. Patented Sept. 21, 1886.

Fig. 1.

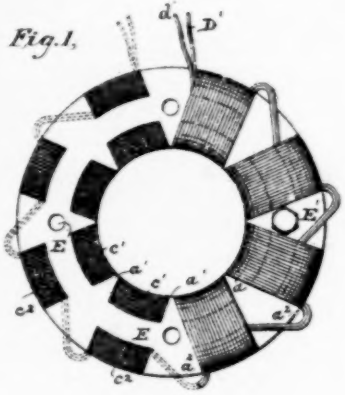


Fig. 2.

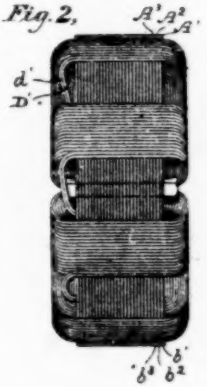


Fig. 3.

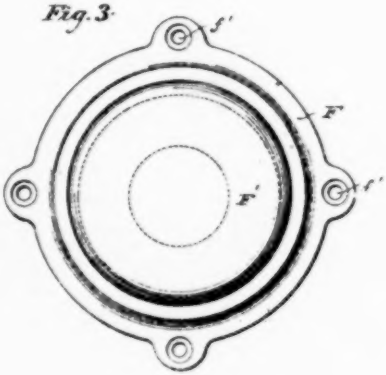
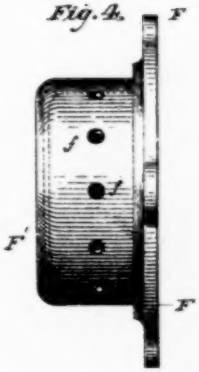


Fig. 4.



Witnesses

Geo. W. Brock

Chas. C. Ashley

Inventor

William Stanley Jr.

By his Attorneys

Poppe & Edgecomb

UNITED STATES PATENT OFFICE.

WILLIAM STANLEY, JR., OF GREAT BARRINGTON, MASSACHUSETTS, ASSIGNOR TO GEORGE WESTINGHOUSE, JR., OF PITTSBURG, PA.

INDUCTION-COIL.

SPECIFICATION forming part of Letters Patent No. 349,612, dated September 21, 1886.

Application filed November 23, 1885. Serial No. 183,725. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM STANLEY, Jr., a citizen of the United States, residing in Great Barrington, in the county of Berkshire and State of Massachusetts, have invented certain new and useful Improvements in Induction-Coils, of which the following is a specification.

My invention relates to the construction of induction-coils or inductoriums.

The object of the invention is to provide an induction-coil adapted to convert currents of a given electro-motive force into currents of a different electro-motive force, or having a different potential, with as small a loss of energy as possible.

The invention is designed especially for employment in electric-lighting systems, or in systems where translating devices of any character are employed in the secondary circuits of induction-coils.

The invention consists in organizing an induction-coil, or, as it may be termed, a "converter," in substantially the following manner: A number of thin iron rings or annular plates are formed, preferably by stamping, and these have interior and exterior teeth around their peripheries. The internal teeth taper to points, their lengths being equal to the thickness to which it is designed they shall be wound with the insulating-conductors constituting the primary and secondary coils. The external teeth extend outward an equal distance; but instead of tapering they diverge, leaving openings having parallel sides. The number of these plates depends upon the conditions under which the converter is to be employed. They are placed upon each other, the positions of the teeth coinciding; but they are insulated or separated from each other by paper, cloth, asbestus, oil-silk, air, or other well-known insulating material, and they are firmly bolted or otherwise secured together. The number of plates which are thus assembled is, as already stated, dependent upon the purpose to which the induction-coil is to be adapted. For instance, if it is designed that it shall absorb five hundred Watts energy, a certain number of plates are used; if one thousand Watts, twice that number. The plates are so placed that two positions of the teeth coincide, leaving openings upon the interior and exterior of the ring between the teeth, and in these openings the conductors are wound. The primary and secondary may be wound together—that is to say, parallel with each other—or the one may be wound outside the other; or they may be placed in alternate spaces between the teeth; or they may be alternately superposed in the alternate spaces—that is to say, the primary may be inside the secondary in one opening and outside the secondary in the next opening.

In the accompanying drawings, Figure 1 is a plan view, partly in section, of an induction-coil embodying the features of the invention, and Fig. 2 is a side elevation of the same. Fig. 3 is a plan view of an inclosing case, and Fig. 4 is a side elevation of the latter.

Referring to the figures, A' A'' A''', &c., represent a series of thin plates or laminæ of soft iron placed side by side and separated by insulating material, as indicated at b' b'' b''', &c. The plates are each constructed with a series of inwardly-projecting pointed teeth or lugs, a' a''. A series of outward projections, $a^{\times}$ $a^{\times}$, are formed opposite the inner projections or teeth a', and the lines of the outer teeth fall in the continuations of the outside lines of the inner teeth, so that the outer teeth widen toward their ends in the same proportion as the inner teeth converge. Rectangular openings c' c'' and $c^{\times}$ $c^{\times}$ are thus left upon the inner and upon the outer edges or sides. The lines bounding the openings thus formed are parallel with each other. A number of the plates are fastened together by bolts e', extending through corresponding holes, e, in the plates, the positions of the teeth of the several plates and laminæ coinciding with each other, and preferably the bolts are insulated from the plates themselves. It is designed that the primary and secondary coils D and d' shall be wound in these openings, and they may be either wound together, the primary wire D and the secondary d' being placed side by side and wound parallel, as shown in Figs. 1 and 2; or the primary wire and secondary wires may be variously disposed with reference to each other.

The coil is preferably protected by being placed within a suitable case consisting of a

241
318

base, F, to which there is secured a removable cover, F'. In the cover there are preferably formed perforations *f f*. For convenience in fastening the coil in position the base F is provided with holes *f'*, by means of which it may be screwed or bolted to any suitable support.

I claim as my invention—

1. An induction-coil consisting of the combination of a series of thin sheet-iron rings placed side by side, and having inwardly and outwardly projecting teeth, and primary and secondary coils wound thereupon at right angles to the direction of the laminæ of the plates.

2. An induction-coil consisting of a series of thin iron plates, having teeth upon its inner and outer peripheries and two conductors wound between the teeth.

3. The combination, substantially as hereinbefore set forth, of an induction-coil consisting of the combination of a series of plates of soft iron, each plate having a series of narrowing inwardly-projecting teeth, a corresponding series of widening outwardly-projecting teeth, and two insulated electric conductors wound in the spaces between the teeth, substantially as described.

In testimony whereof I have hereunto subscribed my name this 17th day of November, A. D. 1885.

WILLIAM STANLEY, JR.

Witnesses:
DANL. W. EDGECOMB,
CHARLES A. TERRY.

No. 479
Washington and Lafayette. } p. 320

(No Model.)

W. STANLEY, Jr.

ELECTRICAL CONVERTER.

No. 428,574. Patented May 20, 1890.

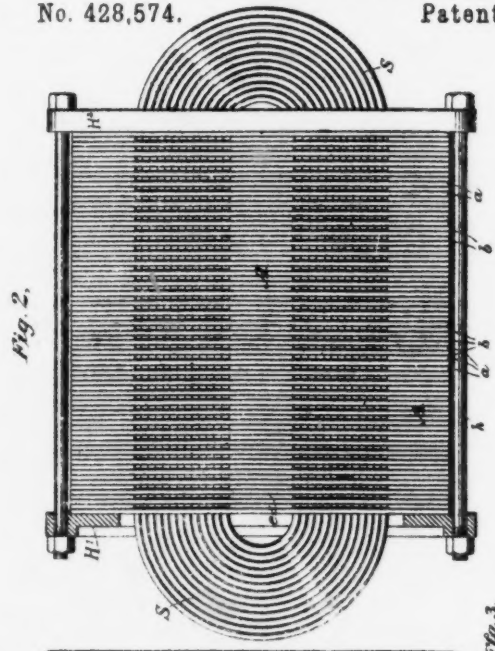


Fig. 2.

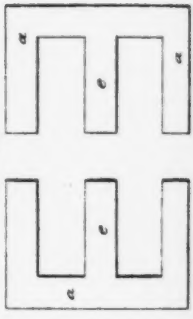


Fig. 3.

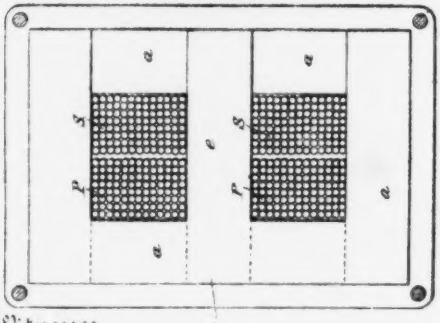


Fig. 1.

Witnesses
Jr. W Bruck
Harry E Stanley

Inventor
Wm. Stanley Jr.
By his Attorneys
Poped Edgecomb

UNITED STATES PATENT OFFICE.

WILLIAM STANLEY, JR., OF GREAT BARRINGTON, MASSACHUSETTS, ASSIGNOR TO GEORGE WESTINGHOUSE, JR., OF PITTSBURG, PENNSYLVANIA.

ELECTRICAL CONVERTER.

SPECIFICATION forming part of Letters Patent No. 428,574, dated May 20, 1890.

Application filed November 23, 1886. Serial No. 219,552. (No model.) Patented in England July 12, 1887, No. 9,726; in France July 12, 1887, No. 184,768; in Belgium July 12, 1887, No. 78,165; in Germany July 12, 1887, No. 43,684; in Italy July 12, 1887, XLIII, 356, and in Canada November 10, 1887, No. 27,964.

To all whom it may concern:

Be it known that I, WILLIAM STANLEY, Jr., a citizen of the United States, residing in Great Barrington, county of Berkshire, and State of Massachusetts, have invented certain new and useful Improvements in Electric Converters, (for which I have obtained Letters Patent in England July 12, 1887, No. 9,726; in France July 12, 1887, No. 184,768; in Belgium July 12, 1887, No. 78,165; in Germany July 12, 1887, No. 43,684; in Italy July 12, 1887, XLIII, 356, and in Canada November 10, 1887, No. 27,964,) of which the following is a specification.

The invention relates to apparatus employed for transforming alternating, pulsatory, or intermittent primary electric currents into alternating, secondary, or induced currents. Devices for this purpose are technically termed "inductoriums," "transformers," or "converters." When an alternating, intermittent, or pulsatory current is made to traverse an electric conductor, a magnetic field is produced in its vicinity the intensity and polarity of which depend upon the character of the originating current, and any mass of magnetizable material—for instance, iron—situated within this field becomes magnetic. The alternating magnetization and demagnetization of such a mass of iron or the reversal of its magnetic polarity in its turn tends to produce corresponding electro-motive forces in neighboring conductors. Such electro-motive forces give rise to electric currents when these conductors form a closed circuit; hence the mass of iron reacts inductively both on the conductor traversed by the originating or primary current as well as upon any other conductor within its influence. An independent conductor thus placed within the inductive field is called a "secondary conductor."

It is well known that in an apparatus of this kind the net efficiency of electric conversion from a primary to a secondary current with a given weight of metal is largely increased by forming the magnetizable mass or "core," as it is technically termed, into a closed magnetic circuit or ring. It is also known that the efficiency of the apparatus is greater if the mass of iron forming the core be laminated in a direction approximately parallel to the lines of magnetic force within the field to prevent the production of Foucault currents. Higher efficiency, other things being equal, is also assured if the mass of magnetizable material be symmetrically disposed about the mean axis of the transverse section of the coils formed by the primary and secondary conductors.

The object in the present invention is to provide a converter in which all the advantages above enumerated shall be combined as far as practicable.

In the accompanying drawings, Figure 1 is an end view (the coil being in section) of a converter embodying the invention, and Fig. 2 is a side view of the same. Fig. 3 is a detached view (drawn to a reduced scale) showing two of the plates of which the core is composed.

Referring to the figures, P S respectively represent the primary and secondary conducting-wires, which constitute the coils of the converter. In Fig. 2 these coils are shown as separated from each other by an intervening insulating-space. These coils serve, respectively, for conducting the inducing and the induced currents.

The core A is composed of a number of plates *a a* of soft iron, which may with advantage be made very thin. These plates may be separated from each other by intervening layers *b b* of non-conducting material. Each individual plate is formed with three lateral tongues projecting in the same direction, as shown in Figs. 1 and 3, so that the configuration of the finished plate resembles that of the letter E.

In building the converter the electric conductors are first wound into oval or flattened coils, which may with advantage be of rectangular cross-section. The plates *a a* are then applied, the middle tongue *c* being inserted in the space within the coils, while the exterior tongues and the bodies of the plates

248

surround the exterior of the coils on three sides.

In assembling the plates to form the core each alternate plate is inserted from the opposite side, and in this way the aggregate mass of iron necessarily becomes symmetrically distributed on every side of the mean axis of the transverse section of the coiled conductors.

The plates are securely bound together by means of the end frames or heads H' H^2, connected by longitudinal bolts *h h*.

In another application, filed on the 6th day of March, 1889, No. 302,141, the method of building or constructing converters herein set forth is claimed.

I claim as my invention—

1. A core for electric converters, composed of separate E-shaped plates symmetrically disposed about the coiled conductors, as set forth.

2. In an electrical converter, the combination, with the coiled conductors, of a core composed of a number of plates separated from each other and alternately arranged about the coiled conductors in the manner described, so that the mass of the core is symmetrically disposed about the mean axis of the coils.

3. The combination, with a coiled primary conductor, of a core consisting of a number of plates, each of which plates is provided with three projecting tongues, one situated within and the other two without the coil, as set forth.

4. A core for electrical converters, consisting of superposed E-shaped plates of soft iron, a portion of the said plates having their tongues projecting in one direction and the remainder having their tongues projecting in the opposite direction, leaving two openings for the conductors, substantially as described.

5. In an induction-coil, a core of soft iron, composed of insulated E-shaped plates, each inclosing a coiled conductor on three sides, said plates being alternately inserted from opposite sides of said coiled conductor, as set forth.

6. A core-plate for electric converters, consisting of a main body, and three arms or tongues projecting therefrom in the same general direction.

7. A core for electric apparatus, composed of thin plates of soft iron and sheets of insulating material pasted or otherwise fastened to one surface thereof.

In testimony whereof I have hereunto subscribed my name this 19th day of November, A. D. 1886.

WILLIAM STANLEY, JR.

Witnesses:
DANL. W. EDGECOMB
CHARLES A. TERRY.

No. 179.
Westinghouse } p. 3 m
Wagner.

(No Model.)

E. THOMSON.

MEANS FOR PREVENTING FLASHING BETWEEN ELECTRIC CONDUCTORS.

No. 265,936. Patented Oct. 10, 1882

Fig. 1

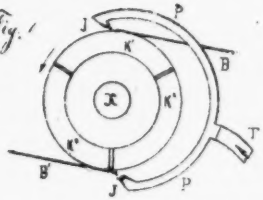


Fig. 2



Fig. 3

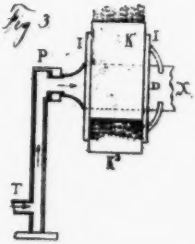


Fig. 4

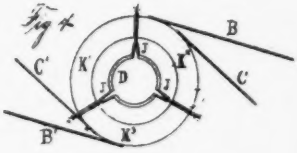


Fig. 5

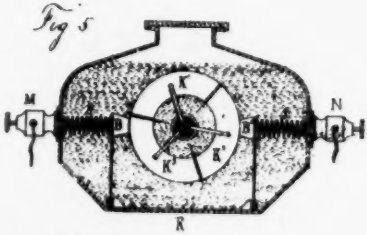
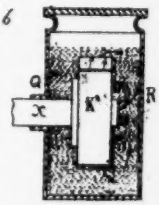


Fig. 6



Witnesses
W B Thomson
Ed Wilbur Rice

Inventor
Elihu Thomson

UNITED STATES PATENT OFFICE.

ELIHU THOMSON, OF NEW BRITAIN, CONNECTICUT.

MEANS FOR PREVENTING FLASHING BETWEEN ELECTRIC CONDUCTORS.

SPECIFICATION forming part of Letters Patent No. 265,936, dated October 10, 1882.

Application filed February 12, 1882. (No model.)

To all whom it may concern:

Be it known that I, ELIHU THOMSON, of the city of New Britain, county of Hartford, and State of Connecticut, have invented certain new and useful Improvements in Means for Preventing Flashing between Electric Conductors, of which the following is a specification.

I will proceed to describe my invention as to commutators of dynamo-electric machines, as that is the case where I find it most desirable to be applied.

My invention in such application has for its object the prevention of what is technically known as "flashing," which occurs from a false adjustment of the brushes on a commutator. Its purpose is to prevent the current of the machine from "arcing" over the spaces between the commutator plates or segments and momentarily destroying their insulating power. This is termed "flashing" because the discharge is accompanied by a bright flash of flame, apparently encircling or partly encircling the commutator. It will readily be understood that where two consecutive segments of a commutator are separated by a slot containing air, and said two segments possess a great difference of electric potential, any action which permits a conducting material to fill said slot will cause short-circuiting and flashing over the slot. My invention prevents the occurrence of such action by providing a constantly-renewed insulation in said slot, and thereby effectually removing and disturbing any heated stream of vapor (momentary or otherwise) that would both cause damage to the materials of the commutator and have a bad effect on the current generated.

It is a well-known fact that commutators used on high-tension dynamo-electric machines are very sensitive to excess of oil or lubricant, although it is desirable to be able to freely oil them, and thus prevent wear. A commutator can be flooded with lubricant without causing trouble, and there is scarcely any wear upon it, with the application of a stream or jet of insulating-fluid acting mechanically after the manner hereinafter described. To this end I cause a stream of insulating-fluid to flow through the slot, either constantly or at proper intervals, with such violence or force as to act mechanically, as it were, in preventing the establishment of a conducting-path for the electric current by forcing aside or displacing the line of particles through which the current may be about to form a path for itself, or to mechanically displace any electric current or stream that may have formed for itself a conducting-path through or over the non-conducting fluid. I may illustrate the principle upon which my invention is founded by an example. Supposing a circuit of twenty arc lights in series being operated from a suitable source of electricity, the tendency to the maintenance of said circuit is very great, so that if broken at any [illegible] a long arc or flame follows the separating portions of the conductor; but a powerful blast of air or other insulating-fluid striking one of the arcs of the circuit will immediately break the circuit. This break will much more readily be effected when the energy acting to cause discharge is comparatively feeble, as is the case with that tending to bridge the slots of a commutator. The reasons for this will be readily understood by those versed in the art.

Briefly, then, my invention consists in forcing through the slots between the segments of a commutator a blast of air or insulating-fluid, which acts, as it were, mechanically to prevent the establishment of an electric current, or to displace any electric current or conducting-line of particles for said current that may momentarily form. In those cases, therefore, where an insulating-fluid separates the conductors to be insulated my invention may be said to consist in superadding to the natural insulating qualities of said fluid a positive or artificial insulating effect due to the mechanical action of said fluid when put in rapid motion.

I do not here limit myself to any form of commutator, but intend the same to include all manner of devices for transfer of electric current and open-circuiting devices. In general I apply my invention to effect and maintain an insulation between any two conductors separated by an interval. It will be apparent, however, from what has been said as to the mechanical action of the current of air, that my invention is not confined to those cases in which the interval between the con-

252

326

ductors is filled with a fluid insulator, but that it may be applied to commutators, or other devices in which the insulation is normally maintained by the intervention of a solid insulating material, the air about the surface of the commutator, or at those points where there is a tendency to the formation of a current or spark through the air, being put in motion so as to act mechanically in preserving the electric individuality or insulated condition of the parts. Neither do I limit myself to any particular device for pumping or supplying the stream of air used in my invention. I may employ an air-pump, a bellows, or fan-blast, or cause the passage of air or other fluid through the insulating-slot by establishing differences of pressure in any well-known manner. The motion of the parts of the commutator may itself be made to furnish the desired stream. In all cases, however, the force or rapidity of the stream is to be sufficient to give to it the positive mechanical action before explained. ✱

Figure 1 shows my invention applied to a three-segment commutator; Fig. 2, a view taken of a portion of Fig. 1, at right angles to it, and shows the face of a commutator-segment, K. Fig. 3 shows a modification, in which a stream of fluid is shown issuing from the slots of a commutator; Fig. 4, a front view of a portion of Fig. 3, showing the issuing streams through the commutator-slots and jets for directing the same. Fig. 5 is a view showing a modification adapted to the use of liquid insulating substances, consisting of a casing to inclosed commutator. Fig. 6 is a view of same parts as in Fig. 5, but seen from side of shaft X, instead of its end.

For carrying my invention into practice I employ, in addition to the break-piece or commutator and brushes, a suitable device for effecting a flow of fluid through or across the spaces to be kept in an insulating condition.

In Fig. 1, $K' K^2 K^3$ are the three separate insulated segments of a commutator-ring surrounding and revolving with the shaft X, as usual in the art. They are of course in electric connection with armature-coils of a magneto-electric machine or other sources of electric current. Brushes B B' are applied as usual. I further apply a pipe or conduit, P P, feeding jets J J from a supply-tube, T, for throwing upon the face of the revolving commutator, immediately in front of the tips of the brushes, as shown, a strong stream of air, which enters the slots between the segments at the moment said slots pass the tips of said brushes B B'. This moment coincides with the time of production (if there be any) of spark connecting the segments across the slot. The blast of air, however, so breaks up and disturbs or displaces the spark as to prevent its being the means of effecting connection between the segments. This action it effects by its cooling influence and by its mechanical effect combined.

In Fig. 2 the jet J is seen in front discharging its stream into the passing slot. Instead of forcing the stream from without inward and having it enter the slots only at intervals, as above, it may pass outward and be continuous through the slots. This is shown in Figs. 3 and 4, where X is a revolving shaft of an electric generator, and $K' K^2 K^3$ the segments of the commutator, supported upon the usual insulation, I I. A chamber or tube, D, revolving with the shaft, has an inlet-opening which fits within the end of an air-supply tube, P T. Around this chamber jets J J J Fig. 4, are situated in line with the slots of the commutator.

In Fig. 4 B B' and C C' bear upon the commutator-segments. The jets J J J revolve and maintain their relation to the slots, and at the same time continuously discharge currents of air outward through said slots. The effect is, as before described, in improving the insulation of said slots.

In Fig. 5 is a modified arrangement, in which non-conducting oil or similar liquid is forced through the slots of the commutator, and so improves the insulation. It consists of a casing, R, surrounding the commutator $K' K^2 K^3$, not rotating with it. An open space into which oil may be placed is thus provided. A space also exists anterior to the segments $K' K^2 K^3$, and between them and the shaft. Blocks of conductor B B', held in contact with the commutator by suitable springs, S S, carry the current to the posts M N, insulated from one another.

The closed box or casing R is shown in Fig. 6 in section parallel to the shaft X. A suitable joint or packing exists at Q to prevent escape of oil from the case. The casing does not revolve with the shaft. The oil enters at the center of the commutator, and is thrown outward through the slots by centrifugal action during rotation, its course being indicated by arrows in the figure. The stream of liquid insulator effects the same object as the air in the preceding descriptions.

I am aware that the use of an insulating-fluid, broadly, is not new; but I am not aware that my special application, herein described, of a jet or current of an insulating-fluid in such a way that it shall act mechanically, in the manner set forth, to prevent the formation of a cross-connection, or to displace or remove such cross-connection if formed; has ever before been proposed or used.

I make no specification herein to the device shown in Figs. 5 and 6, but reserve the same for the subject of another application.

Various modifications of the devices herein shown may be employed without essentially changing the nature of my invention; and, therefore,

What I claim broadly is—

1. The herein-described method of improving and maintaining the insulation of two electric conducting plates or surfaces, consisting in forcing between them or across the intervening space by which they are separated a jet or stream of an insulating-fluid of sufficient

✱ (Here follows diagram marked p.324.)

strength to act mechanically, in the manner set forth, to prevent the formation of any conducting-line of particles or to displace or dissipate any electric current or stream that may have established a path for itself.

2. The combination, with two conducting bodies or surfaces in different states of electric excitement, of suitable means for forcing into, across, or through the space by which they are separated a jet or stream of an insulating-fluid having a sufficient force or strength to act mechanically, in the manner described, in aiding or maintaining the insulation of such surfaces.

3. The combination, substantially as described, with a moving commutator or circuit-changing device, the parts of which are separated by free air-spaces, of a jet or stream of insulating-fluid sent through the insulating or separating spaces with a sufficient force to act mechanically, in the manner described, to maintain or restore the insulation of the parts.

4. The combination, with a cylindrical commutator the plates of which are separated by free air-spaces, of air ducts or pipes applied, in the manner described, so as to direct a jet or current of an insulating fluid radially between the plates, said jet or current being of a sufficient force or strength to act mechanically, in the manner described, so as to re-enforce the natural insulating quality of the fluid.

5. The combination, with the commutator of a dynamo-electric machine constructed in the manner described, of a series of plates or segments separated from one another by free spaces, means, substantially as described, for directing a current of insulating-fluid into, through, or across the free spaces at the point in the revolution of the commutator immediately after a segment or plate leaves a commutator-brush.

6. The combination, with a commutator having a collecting-brush applied thereto, of an attachment, P, and jets J, directed upon the commutator at points immediately succeeding that at which the collecting-brush and a commutator segment or plate are disconnected from one another.

7. The combination, with a revolving commutator, of jets J, applied to the interior thereof and directed into the spaces between the successive commutator plates or segments.

8. The combination, with the revolving commutator, of the jets J, attached to the interior of said commutator and revolving therewith, and the stationary supply-pipe, substantially as and for the purpose described.

ELIHU THOMSON.

Witnesses:
W. B. THOMSON,
E. WILBUR RICE.

(No Model.) 2 Sheets—S

A. SCHMID.

ELECTRICAL CONVERTER.

No. 366,347. Patented July 12,

Fig. 2.

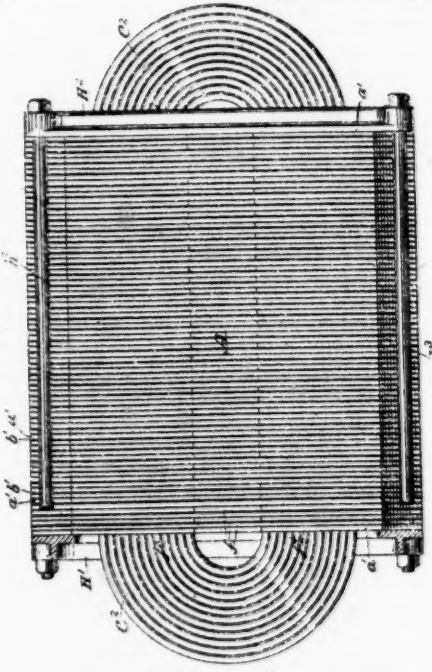
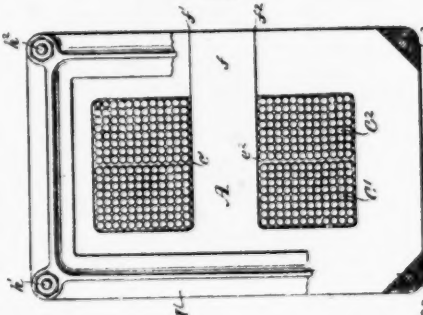


Fig. 1.



Witnesses

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No. 79.
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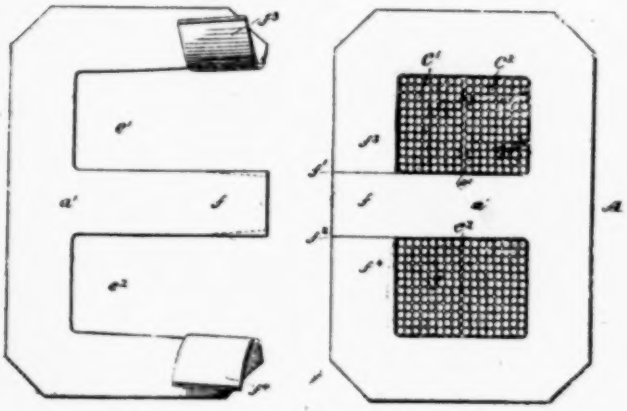
(No Model.) 2 Sheets—Sheet 2.

A. SCHMID.

ELECTRICAL CONVERTER.

No. 366,347. Patented July 12, 1887.

Fig. 3.



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Annie E. Ashley

Inventor
Albert Schmid

By his Attorneys
Pope & Edgecomb

UNITED STATES PATENT OFFICE.

ALBERT SCHMID, OF ALLEGHENY, ASSIGNOR TO GEORGE WESTINGHOUSE, JR., OF PITTSBURG, PENNSYLVANIA.

ELECTRICAL CONVERTER.

SPECIFICATION forming part of Letters Patent No. 366,347, dated July 12, 1887.

Application filed December 27, 1886. Serial No. 223,515. (No model.)

To *all whom it may concern:*

Be it known that I, ALBERT SCHMID, a citizen of the Republic of Switzerland, residing in Allegheny, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Electrical Converters, of which the following is a specification.

The invention relates to the construction of induction-coils or electric converters.

It has been the practice to employ electric converters for transforming electric currents of any given quantity and electro-motive force into currents in which these factors are varied. These converters consist of cores of soft iron, wound with two or more coils of insulated wire, termed the "primary" and "secondary" coils. These coils may be variously proportioned with reference to each other to produce the required changes in the conditions or factors of the current. The best practical results would seem to be secured when the wire is very largely surrounded by soft iron. When a considerable mass of soft iron is applied, it is also desirable that it be capable of rapid magnetic charge and discharge. This result is best attained by forming the core of thin plates or sheets of soft iron.

The object of this invention is therefore to provide a converter having its core formed of thin plates, each plate surrounding both sides of the coils.

In the accompanying drawings, Figure 1 is an end view, partly in section, and Fig. 2 is a plan, partly in section, of a converter embodying the features of the invention. Fig. 3 illustrates the method of applying the core-plates to the coils.

Referring to the figures, A represents the core of a converter, and C' and C'' are respectively the primary and secondary coils. The core is composed of thin iron sheets or plates *a' a'*, alternate ones of which are magnetically separated from each other by thin sheets *b' b'* of non-conducting material—such, for instance, as paper. These sheets may with advantage be pasted or glued to the plates of iron.

In preparing the plates *a' a'*, rectangular sheets are stamped with two holes, *c' c'*, which are themselves preferably rectangular in form, and they are of such size as to receive the primary and secondary coils C' and C''. Each opening *c'* and *c'* is cut open, as shown at *f'* and *f''*, respectively, the cuts being preferably in a line with the inner edges of the corresponding openings. It may not always be found necessary to have the cuts exactly in line with these edges, but one or both of them may be in a diagonal direction, as indicated by the dotted lines, Fig. 3. This has the advantage of sharpening the tongue *f* and making it more easy to insert it in the coils.

The central tongue, *f*, is designed to extend through the interior of the coils. The separate plates are then applied to the coils by springing the portions *f'* and *f''* backward, in the manner shown in Fig. 3, then thrusting the tongue *f* through the coils and allowing the plate to return to its normal position. The iron which it is found preferable to use is so thin that the operation may be very readily performed by hand without the use of machinery.

For the purpose of breaking joints, the alternate plates *a' a'* are preferably inserted from opposite sides, so that the slits *f' f''* of one plate are against the solid portions of the two adjacent plates. It is preferred to place the plates so that the bare metallic surfaces of two plates rest against each other, and the opposite insulated surfaces of these plates rest against corresponding insulated surfaces of their contiguous plates. The insulated surfaces may, however, all lie in one direction.

In building the converter, the plates are temporarily pressed together, as may be found necessary, by clamps or in any convenient manner. The plates, when as many as practicable have been inserted, should be tightly pressed against each other, and to accomplish this, two plates, H' and H², are placed at the respective ends of the converter and bound against the same by four bolts, A', A², A³, and A⁴. The plates H' and H² are preferably of cast brass or iron, surrounding the projecting ends of the coils and resting against the edges of the end plates, *a' a'*. To render the completed converter as compact as possible, the corners of the plates *a' a'* are cut off to allow room for

269
334

the bolts *K K K*. The iron thus removed is of little or no importance as regards the operation of the converter.

I claim as my invention—

1. The combination of the primary and secondary coils of a converter and a core composed of thin flexible plates of soft iron, each formed with two holes, the metal about each hole being cut open for receiving the coils, substantially as described.

2. Metal plates for forming cores for electric converters, constructed with two openings, the metal around each opening being cut apart.

3. A core-plate for electrical converters, consisting of a thin sheet of soft iron having two holes for receiving the respective sides of the coils and a cut from each opening to the outside of the sheet.

4. A core-plate for electrical converters, consisting of a sheet of soft iron having two rectangular holes stamped therein and an opening from each hole approximately in line with the inner edge of the same.

5. A core-plate for electrical converters, consisting of an oblong plate having two openings, the metal about each opening being cut through, substantially as described.

6. An electrical converter consisting of the primary and secondary coils and a series of soft-iron plates having holes for receiving the respective sides of the coils, the metal surrounding the holes being cut apart upon opposite sides in the alternate plates.

7. An electrical converter consisting of primary and secondary coils having a core composed of thin plates of soft iron, each plate having two holes, the metal about each hole being cut open for receiving the coils, and non-magnetic material between alternate plates.

8. A core for electric converters, consisting of thin plates of soft iron, each having two openings, and each two plates being magnetically separated from the adjacent plates, but in magnetic contact with each other.

9. An electric converter consisting of primary and secondary coils and a core of soft-iron plates, each constructed with two openings for receiving the coils, the metal about each opening being cut through and the central tongues thus formed inserted within said coils from opposite sides, and sheets of non-magnetic material between the alternate plates.

In testimony whereof I have hereunto subscribed my name this 27th day of October, A. D. 1886.

ALBERT SCHMID.

Witnesses:
CHARLES A. TERRY,
OLIVER B. SHALLENBERGER.

Defendant's Exhibit No. 19.

N° 9728 A.D. 1887

Date of Application, 12th July, 1887—Specification Accepted, 19th Aug., 1887

COMPLETE SPECIFICATION.

[Communicated from abroad by GEORGE WESTINGHOUSE, Junior, of Pittsburgh, County of Alleghany, State of Pennsylvania, United States of America, Engineer.]

Improvements in Electric Converters and Boxes for same.

I, WILLIAM PHILLIPS THOMPSON, F.C.S. M.I.M.E. of the Agency for Foreign Patent Solicitors, 6 Lord Street, Liverpool, and 6 Bank Street, Manchester, both in the County of Lancaster, and 323, High Holborn, in the County of Middlesex, Civil Engineer, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement :—

The invention relates to apparatus employed for transforming alternating, pulsatory or intermittent primary electric currents into alternating secondary or induced currents. Devices for this purpose are technically termed inductoriums, transformers or converters.

When an alternating, intermittent or pulsatory current is made to traverse an electric conductor, a magnetic field is produced in its vicinity, the intensity and polarity of which depends upon the character of the originating current, and any mass of magnetizable material, for instance, iron, situated within this field becomes magnetic. The alternate magnetization and de-magnetization of such a mass of iron, or the reversal of its magnetic polarity in its turn tends to produce corresponding electro motive forces in neighbouring conductors, which give rise to electric currents when these conductors form a closed circuit; hence the mass of iron reacts inductively both on the conductor traversed by the originating or primary current as well as upon any other conductor within its influence. An independent conductor thus placed within the inductive field is called a secondary conductor.

In the accompanying drawings, figure 1 is an end view (the coil being in section) of one form of a converter, and figure 2 is a side view of the same; Figure 3 is a detached view (drawn to a reduced scale) showing two of the plates of which the core is composed. Figures 4, 5 and 6 illustrate a modified form; Figures 7, 8 and 9 illustrate a containing box.

[*Price* 8d.]

*(Here follow diagrams marked pp. 341 & 343.)

N° 9728.—A.D. 1887.

Thompson's Improvements in Electric Converters and Boxes for same.

Referring to the figures 1, 2 and 3, P S represent the conducting wire or wires which constitute the coil of the converter. Two similar coils P and S are shown in the section (figure 2) as separated from each other by an intervening insulating space; but a single coil only may be employed, which may serve for both the inducing and the induced currents. In such case, the space occupied by the primary and secondary coils, P and S (figure 2) is filled with the primary coil alone. The core A is composed of a number of plates *a a* of soft iron, which may with advantage be made very thin. These plates are electrically and magnetically separated from each other by intervening sheets *b b* of non-conducting and non-magnetic material, thin linen paper of good quality being found to serve an excellent purpose. The sheets of paper may be secured by paste or other convenient means to one or both sides of each plate, before it is placed in the converter. Each individual plate is formed with three lateral tongues projecting in the same direction (figures 1 and 3) so that the configuration of the finished plate resembles that of the letter E. The electric conductor or conductors, having first been wound in an oval or flattened coil preferably of rectangular cross section, the plates *a a* are inserted so that the middle tongue E occupies the space within the coil, while the exterior tongues together with the body of the plate, surround the exterior of the coil on three sides. In assembling the plates to form the core, each alternate plate is inserted from the opposite side, and in this way, with an even number of plates, the total mass of iron necessarily becomes symetrically distributed on every side of the mean axis of the transverse section of the coiled conductor or conductors.

The plates are securely bound together into a mass to form the core by end frames or heads H^1 and H^2, connected together by longitudinal bolts *h h*.

In some instances it may be found desirable to extend the ends of the outer arms on the soft iron plates toward each other or toward the central tongues, as will be described with reference to figures 4, 5 and 6. Referring to these figures, the core is composed in this instance of thin iron sheets or plates *a a* alternate ones of which are magnetically separated from each other by the thin sheets *b b* of non-conducting material.

In preparing the plates *a a*, rectangular sheets are stamped with two holes e^1 e^2, which are themselves preferably rectangular in form, and they are of such size as to receive the primary and secondary coils P and S.

Each opening e^1 and e^2 is cut open as shown at f^1 and f^2 respectively, the cuts being preferably in a line with the inner edges of the corresponding openings. It may not always be found necessary to have the cuts exactly in line with these edges, but one or both of them may be in a diagonal direction as indicated by the dotted lines (figure 6). This has the advantage of sharpening the tongue *f* and making it more easy to insert it in the coils.

The central tongue *f* is designed to extend through the interior of the coils. The separate plates are then applied to the coils by springing the portions f^3 and f^4 backward, in the manner shown in figure 6, then thrusting the tongue *f* through the coils and allowing the plate to return to its normal position. The iron, which it is found preferable to use, is so thin that the operation may be very readily performed by hand, without the use of machinery.

For the purpose of breaking joints, the alternate plates *a a* are preferably inserted from opposite sides, so that the slits f^1 f^2 of one plate are against the solid portions of the two adjacent plates. It is preferred to place plates so that the bare metallic surfaces of two plates rest against each other, and the opposite insulated surfaces of these plates rest against corresponding insulated surfaces of their contiguous plates. The insulated surfaces may, however, all lie in one direction.

In building the converter the plates are temporarily pressed together as may be found necessary by clamps or in any convenient manner.

The plates, when as many as practicable have been inserted, should be tightly pressed against each other, and to accomplish this two plates H^1 and H^2 are placed at the respective ends of the converter and bound against the same by four bolts h^1, h^2, h^3 and h^4. The plates H^1 and H^2 are preferably of cast brass or iron, surrounding the

projecting ends of the coils and resting against the edges of the end plates. To render the complete converter as compact as possible the corners of the plates *a a* are cut off to allow room for the bolts h^1, h^2, h^3 and h^4.

The iron thus removed is of little or no importance as regards the operation of the converter.

The primary and secondary coils are separately wound and wrapped with suitable insulating material, and they may be usually with advantage separated from each other a slight distance by suitable insulating material, such for instance, as leatheroid or white fibre. Narrow strips of the same material may also be placed between the remaining sides of the coils and the surrounding metal.

In the figures, bands a^3 of cotton cloth or canvas are shown as wound upon the coils and coated with shellac or other non-conducting material. The coils are then placed side by side, in some instances separated by strips or plates of leatheroid or white fibre or other suitable non-conducting substance as shown at a^2. Narrow strips of the same material may be bound against the sides of the coils, as shown at a^1 a^4. The core of soft iron is then applied.

By means of these separate coverings, the insulation between the two circuits is rendered more perfect, and a great reduction of the static capacity of the core is secured, since only the small external surfaces are presented to each other, and these are some distance from each other; and also the converter is much more easily constructed and different standard coils may be placed in different converters, where different ratios of conversion are desired.

The box is illustrated in figures 7, 8 and 9. The main portion of the box is formed in two parts, one of which is designed to be secured at the top and bottom to suitable portions, such for instance as the cross-arms placed upon poles in the manner adopted in constructing telegraph lines; while the other section of the box is secured to the first named section and carries two compartments, the one designed to receive the terminals of the primary and the other the terminals of the secondary coils of the converter. These compartments respectively contain circuit controlling devices upon plates of non-conducting material, and are closed by transparent plates which permit them to be inspected. Metallic discs preferably cover the plates and protect them from injury. A^1 represents the back section and A^2 the front section of the box, and B the converter placed within the box. The section A^1 is constructed with lateral lugs c^1, c^2, c^3 and c^4, for convenience in securing the same to cross arms c^5 and c^6 or other convenient supports. A lateral flange or lug c^7 rests upon the arm or support c^6. The arms c^5 and c^6 may form suitable supports for conveying the primary and secondary conductors, being properly distanced for that purpose.

The front section A^2 is bolted or otherwise securely fastened to the section A^1, as indicated at *c c*. This section A^2 carries two compartments D^1 and D^2 formed by annular webs or lugs being thrown out from the casting. The terminals of the primary coil B of the converter are led through suitable openings P^1 in the casting, into the compartment D^1. The terminals of the secondary coil S are led in like manner through openings S^1 into the compartment D^2. These compartments are preferably constructed with inwardly projecting lugs *d d*, against which there are fastened non-conducting plates e^1 and e^2. These are of fibre, hard rubber or other suitable material. The primary conductors are fastened to bolts or coupling screws f^1 (only one of which is shown), this being fastened to and extending through the plate e^1. The terminals of the secondary coil are in like manner connected upon the under side of the plate e^2 with coupling screws f^2. The connections are continued from these screws, through fusible switch plugs or strips g^2 to switch plates h^2 and i^2 respectively. These plates are connected, at will, by corresponding switch plugs j^2 and k^2 with other contact or switch plates m^2 and n^2. The conductors o^2 o^2 lead from the plates m^2 and n^2 respectively through suitable openings w^2 w^2, in the lower side of the plate or web forming the compartment D^2, such openings being lined with fibre or other suitable non-conducting tubes or thimbles as shown at *r*, *r*. For the purpose of completely insulating the fusible strips and their connected conductors from each other, insulating material r^2 is placed across the compartment D^2, thus preventing an

accidental short-circuit being formed. The openings P^1 and S^1 are also preferably constructed with non-conducting thimbles p^1 and s^1, serving to prevent contact between the iron of the case and the conductors leading through the openings.

The box or compartment D^1 is in like manner equipped with circuit controlling and safety devices as indicated at g^1, i^1, j^1 and n^1, connected with the respective terminals of the primary coil, and the primary conductors lead through suitable openings w^1 at the bottom of the compartment.

The outer ends of the compartments D^1 and D^2 are closed securely by glass plates T^1 and T^2 respectively, and these are preferably held in position by annular clamps t^1 and t^2 and rubber washers t^3 and t^4. The plates of glass allow the circuit connections to be inspected without opening the box. For their better preservation, however, discs u^1 and u^2 are preferably fastened in front of the plates in such manner that they may be easily removed or swung aside when desired.

The converter, as shown in the present instance, consists of the two coils P and S surrounded by plates of iron a, the plates being secured together by bolts h^1, h^2. The converter box is constructed to conform in general shape to the converter, and when placed in position the ends of the rods holding the plates, rest upon the shoulders b^3 and b^4.

For the purpose of preventing the wires of the coil from coming into contact with the iron of the case, suitable shields y and y may be made to project over the ends of the coils, such shields constituting hoods formed upon plates v^1 v^2 fastened to the ends of the core formed by the plates a.

Having now particularly described and ascertained the nature of the said Invention, and in what manner the same is to be performed, as communicated by my foreign correspondent, I declare that what I claim is :

1. A core composed of E-shaped plates, electrically and magnetically separated from each other, and symmetrically disposed about a coiled conductor, as set forth.

2. The combination with a coiled conductor, of a mass of soft-iron composed of detached plates, each plate being provided with three projecting tongues, one situated within and the other without the coil, as set forth.

3. The combination of the primary and secondary coils of a converter, and a core composed of thin flexible plates of soft iron, each formed with two holes, the metal about each hole being cut open for receiving the coils, substantially as described.

4. Metal plates for forming cores for electric converters constructed with two openings, the metal around each opening being cut apart.

5. An electric converter consisting of the primary and secondary coils and a series of soft iron plates having holes for receiving the respective sides of the coils, the metal surrounding the holes being cut apart upon opposite sides in the alternate plates.

6. An electrical converter consisting of primary and secondary coils, having a core composed of thin plates of soft iron, each plate having two holes, the metal about each hole being cut open for receiving the coils, and non-magnetic material between alternate plates.

7. A core for electric converters consisting of thin plates of soft iron each having two openings, and each two plates being magnetically separated from the adjacent plates but in magnetic contact with each other.

8. An electric converter consisting of primary and secondary coils and a core of soft iron plates, each constructed with two openings for receiving the coils, the metal about each opening being cut through and the central tongues thus formed inserted within said coils from opposite sides, and sheets of non-magnetic material between the alternate plates.

9. The combination with the primary and secondary coils of a converter, separately wound and covered with insulating material, of plates of non-conducting material between said coils, strips of non-conducting material extending along the sides of the coils, and a core of soft iron surrounding the coils, leaving air-spaces between said strips.

10. In an electric converter, the combination with the primary and secondary coils separately wound, of plates of insulating material between the coils and strips of insulating material extending along the sides of the coils and separating the same from the surrounding core, substantially as described.

11. The combination, in an electric converter, of a core built up of plates or sheets of soft iron magnetically insulated from each other and having rectangular openings, primary and secondary coils within said openings, and strips of insulating substance separating the coils from the core, substantially as described.

12. The combination with the core of an electric converter, of primary and secondary coils therefor, separately wound and covered with separate insulation, substantially as described.

13. In an electric converter, primary and secondary coils separately wound, and a covering of insulating material applied to each coil independently of the other, substantially as described.

14. The combination of the primary and secondary coils, of an electric converter, said coils being separately wound and separately insulated and placed side by side, and a core of soft iron to which the coils are applied.

15. A converter box constructed in two sections, the one provided with means for securing it to supports, and the other having two separate compartments, for receiving the primary and secondary circuit-controlling devices.

16. A converter box constructed in two parts, the one being provided with separate compartments formed by lateral webs, non-conducting plates within said compartments, and circuit-controlling devices carried upon said plates.

17. The combination with a box for containing an electric converter, of two independent compartments integral therewith for receiving the primary and secondary terminals respectively, non-conducting plates within said compartments, independent circuit-controlling devices for the respective primary and the respective secondary conductors carried by said plates, and non-conducting plates between the respective circuit-controlling devices in each compartment.

18. The combination with a box for containing an electric converter, of independent compartments integral therewith, for containing the primary and secondary circuit-controlling devices, transparent plates closing said compartments and protecting discs outside said plates.

19. The combination with an electric converter, of supports for the primary and secondary conductors respectively, and a box containing the converter secured at one end to the support of the primary conductors and at the other end to the support of the secondary conductors.

20. The combination with an electric converter of supports for the primary and secondary conductors respectively, a box containing the converter secured at one end to the support of the primary conductors and at the other end to the support of the secondary conductors, a compartment for receiving the terminals of the primary coils of the converter, a second compartment for receiving the terminals of the secondary coils of the converter, and openings at the bottom of the respective compartments for receiving conductors leading to the primary and secondary coils respectively.

Dated this 11th day of July 1887.

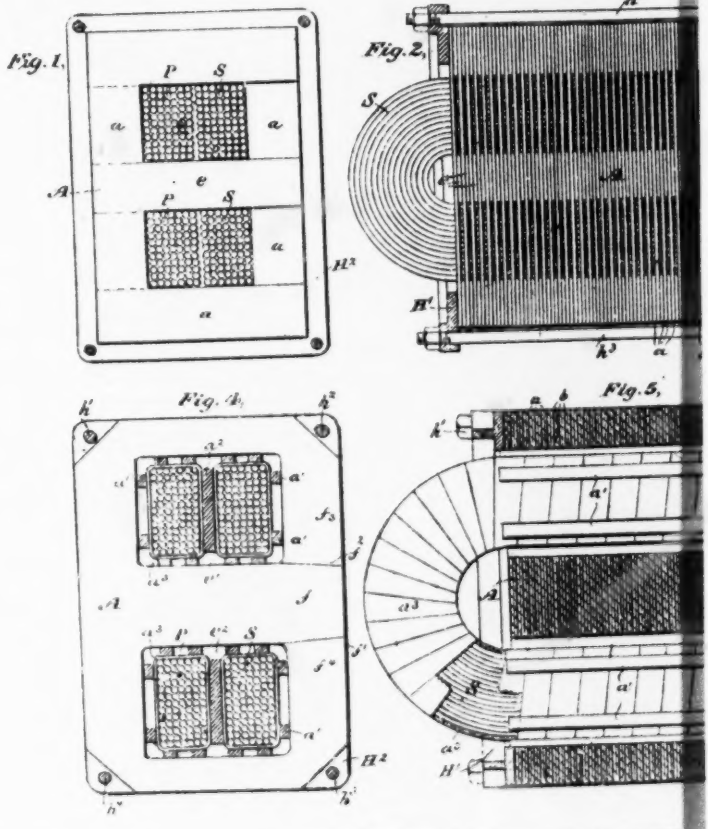
WM. P. THOMPSON & Co.,
Agents for the Applicant.

London : Printed for Her Majesty's Stationery Office, by Darling & Son, Ltd.—G. 388.—50.—9/89.

A.D. 1887. JULY 12. Nº 9728.

THOMPSON'S COMPLETE SPECIFICATION.

(2nd Edition)



No. 179.
Werkzeugmaschinen.
Wägner.

2 SHEETS, SHEET 1

Fig. 2.

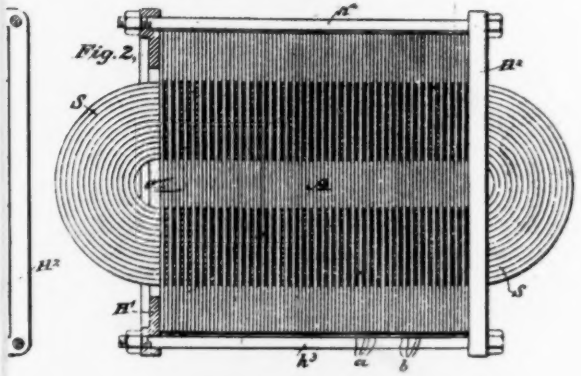


Fig. 3.

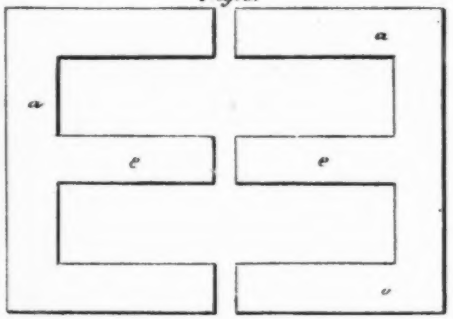


Fig. 5.

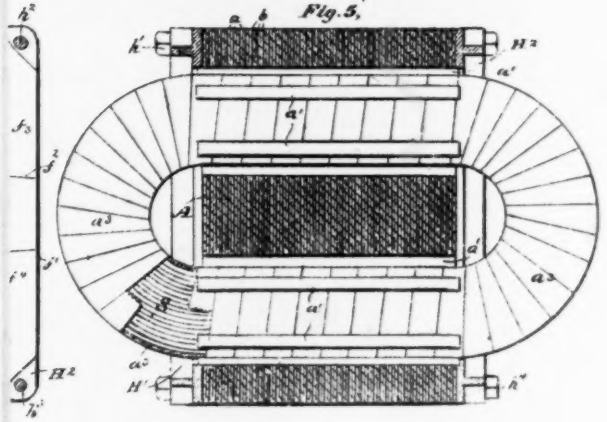
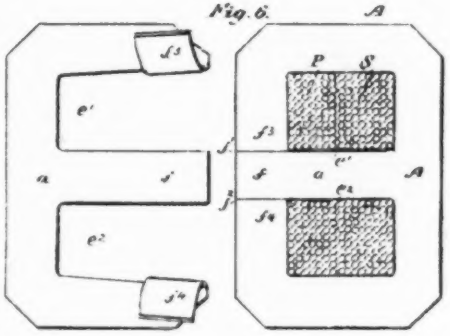


Fig. 6.



(2nd Edition).

Fig. 7.

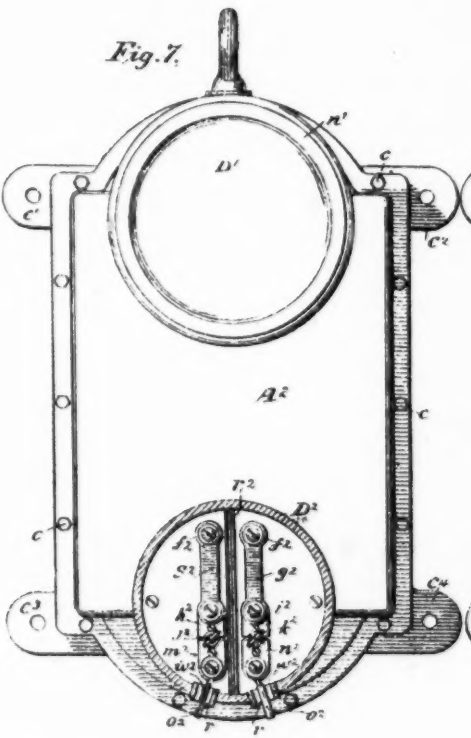
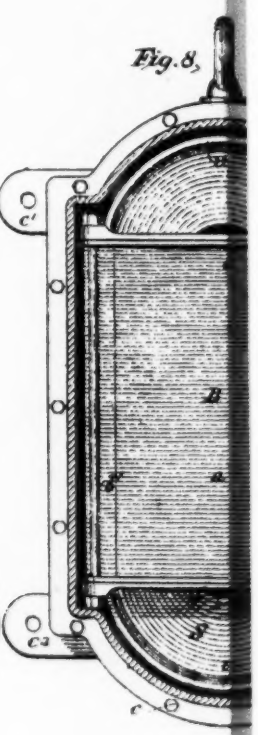


Fig. 8.



London Printed
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Westinghouse
Wagner &c. Sp 3473

Fig. 8.

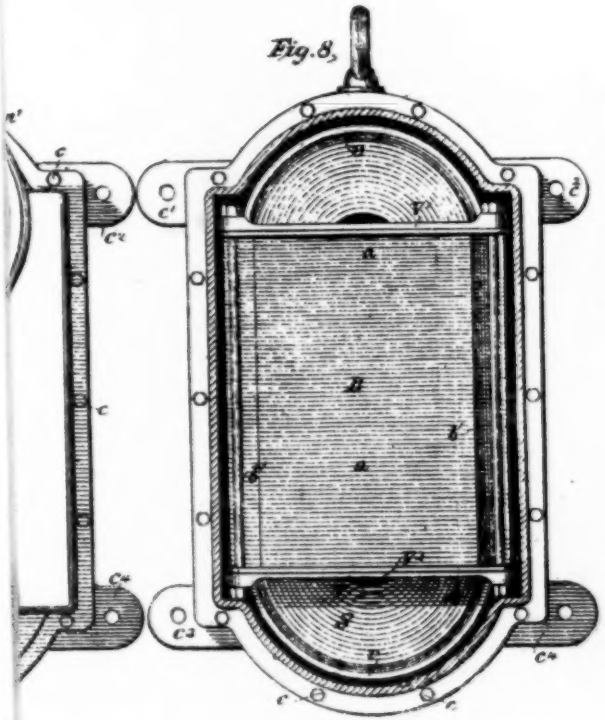
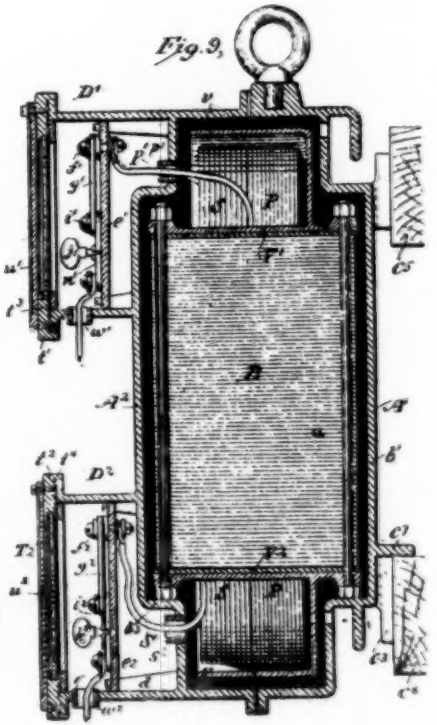


Fig. 9.



London: Printed by Bonnor and Sons Ltd.
for Her Majesty's Stationery Office. 1889.

Mack & Sons, Photo-Litho

Be it Remembered: That heretofore, to-wit: on the 16th
345 day of February A. D. 1904, in a certain cause pending in the Circuit Court of the United States for the Eastern Division of the Eastern Judicial District of Missouri, entitled Westinghouse Electric and Manufacturing Company, Complainant, versus Wagner Electric Manufacturing Company, Defendant, the following proceedings were had and appear of record in said cause, as follows, to-wit:

(*Interlocutory Decree.*)

In the United States Circuit Court, Eastern Division of the Eastern District of Missouri.

No. 4457. In Equity.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, Complainant,
vs.
WAGNER ELECTRIC MANUFACTURING COMPANY, Defendant.

Interlocutory Decree.

This cause having come on to be heard upon the pleadings and proofs herein,

It is ordered, adjudged and decreed as follows:

That letters patent of the United States issued to George Westinghouse, Jr., for Electrical Converter, dated July 12, 1887, and numbered 366,362, and duly assigned to the complainant Westinghouse Electric & Manufacturing Company are good and valid in law, particularly as to the fourth claim thereof, and that complainant, Westinghouse Electric & Manufacturing Company, is the owner of said letters patent and all rights thereunder.

That George Westinghouse, Jr., was the first, true and original inventor of the inventions and improvements described and claimed in claim 4 of said letters patent.

That the defendant herein, Wagner Electric Manufacturing Company has infringed the fourth claim of said letters patent, and upon the exclusive rights of the complainant under the same, by making, using and selling electrical converters or transformers embodying in their construction and principle of operation the combination, substantially as described in said Westinghouse patent, of an electric converter or transformer constructed with open spaces in its core, an enclosing case, and a non-conducting fluid in said case adapted to circulate through said spaces and about the converter or transformer.

That complainant do recover of the defendant the profits,
346 gains and advantages which the said defendant has derived, received or made by reason of said infringement by said defendant of claim 4 of the said Westinghouse patent No. 366,362, and that the complainant do recover of the said defendant any and

all damages which the complainant has sustained by reason of said infringement by said defendant in the manufacture, use or sale of electrical transformers or converters, found to be in infringement of claim 4 of said Westinghouse patent No. 366,362 as hereinbefore specified, or any electrical converters or transformers which embody in their construction and principle of operation the combination substantially as described in said Westinghouse patent, of an electric converter or transformer constructed with open spaces in its core, an enclosing case, and non-conducting fluid or gas in said case adapted to circulate through the spaces and about the converter;

And this cause is hereby referred to Henry H. Denison, Esq., as Special master to take and state an account of said gains, profits and advantages, to assess such damages and to report thereon with all convenient speed; and that the defendant herein, said Wagner Electric Manufacturing Company, its directors, officers, attorneys, clerks, servants and workmen, are hereby directed to attend before said Master from time to time as required and to produce before him such books, papers, vouchers, and documents and to submit to such oral examination as the Master may require.

That a perpetual injunction issue out of and under the seal of this Court, directed to said defendant, Wagner Electric Manufacturing Company, its officers, directors, agents, attorneys, clerks, servants, and workmen, enjoining and restraining them, and each of them from, directly or indirectly, making, or causing to be made, using, or causing to be used, or vending to others to be used in any manner, any electrical converters or transformers containing, embodying or employing the said inventions or improvements claimed by the fourth claim thereof, or from infringing or violating the said letters patent No. 366,362, as to the fourth claim thereof, in any manner whatsoever.

And the Court having heard counsel for complainant and counsel for defendant herein, after due consideration,

It is further ordered, adjudged and decreed

That the electrical converter or transformer referred to in the proofs in this case and illustrated in the printed pamphlet entitled "Wagner Electric Mfg. Co., St. Louis, Mo., U. S. A., Catalogue, No. 102, Bulletin 59, 1903," one of complainant's printed exhibits in this case, to-wit: a converter or transformer having open spaces between the coils and between the coils and the core for the circulation of oil, and known as Wagner, Type M transformer, does not infringe claim 4 of said Westinghouse patent No. 366,362 and that as to this last-named electrical converter or transformer the perpetual injunction hereinbefore referred to does not apply. 347 & 348

And that neither party recover any costs in this action up to and including the entry of this interlocutory decree; but that, in respect to the costs in this action up to and including the entry of this interlocutory decree, each party pay its own costs.

ELMER B. ADAMS, *Judge.*

St. Louis, February 16th, 1904.

And afterwards, to-wit: on the 29th day of July A. D. 1907, there was filed in said cause a Report of the Special Master on the accounting, accompanied by the proofs taken before him and certain volumes of tabulated figures therewith returned, which said Report of the Special Master, proofs and tabulations, are respectively in words and figures as follows, to-wit:

349 UNITED STATES OF AMERICA,
Eastern Division of the
Eastern Judicial District of Missouri:

In the Circuit Court of the United States in and for the Eastern Division of said District.

In Equity. No. 4457.

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY,
Complainant,
v.
WAGNER ELECTRIC MANUFACTURING COMPANY, Defendant.

Report of Henry H. Denison, Special Master.

Whereas, in the above entitled cause this Honorable Court, on the 16th day of February, A. D. 1904, ordered, adjudged and decreed that letters patent of the United States issued to George Westinghouse, Jr., for Electric Converter, dated July 12, 1887, and numbered 366,362, and duly assigned to the complainant, Westing-
350 house Electric and Manufacturing Company, are good and valid in law, particularly as to the fourth claim thereof, and that complainant, Westinghouse Electric and Manufacturing Company, is the owner of said letters patent and all rights thereunder;

That George Westinghouse, Jr., was the first true and original inventor of the inventions and improvements described and claimed in Claim Four of said letters patent;

That the defendant herein, Wagner Electric Manufacturing Company, has infringed the fourth claim of said letters patent, and upon the exclusive rights of the complainant under the same, by making, using and selling electric converters or transformers embodying in their construction and principle of operation the combination, substantially as described in said Westinghouse patent, of an electric converter or transformer constructed with open spaces in its core, an enclosing case, and a non-conducting fluid in said case adapted to circulate through said spaces and about the converter or transformer;

That complainant do recover of the defendant the profits, gains and advantages which the said defendant has derived, received or made by reason of said infringement by said defendant of Claim Four of the said Westinghouse Patent No. 366,362, and that the complainant do recover of the said defendant any and all damages which

the complainant has sustained by reason of said infringement by said defendant in the manufacture, use or sale of electric transformers or converters found to be in infringement of Claim Four of said Westinghouse Patent No. 356,352 as hereinbefore specified,
or any electrical converters or transformers which embody
351 in their construction and principle of operation the combination, substantially as described in said Westinghouse patent, of an electric converter or transformer constructed with open spaces in its core, an enclosing case, and non-conducting fluid or gas in said case adapted to circulate through the spaces and about the converter;

And whereas this cause was, by the same order, referred to me, as Special Master to take and state an account of said gains, profits and advantages, and to assess such damages, and to report thereon;

Now therefore I, the undersigned, Henry H. Denison, in obedience to said order and decree, come and report to this Honorable Court my acts and doings under and by virtue thereof.

The following notice was served by myself in person upon the solicitors for the complainant and defendant respectively:

UNITED STATES OF AMERICA,
Eastern Division of the
Eastern Judicial District of Missouri:

In the Circuit Court of the United States in and for the Eastern Division of said District.

4457.

WESTINGHOUSE ELEC. & MFG. CO., Complainant,
vs.
WAGNER ELEC. MFG. CO., Defendant.

To the Above-named Complainant or to Messrs. Bakewell & Cornwall, its Solicitors:

To the Above-named Defendant or to Messrs. Fowler & Bryson, its Solicitors, and to W. A. Layman, Manager and Treasurer of said Defendant Company:

352 You and each of you are hereby notified that on Tuesday, the 31st day of May, 1904, at the office of Bakewell and Cornwall in the Chemical Building on the corner of 8th and Olive streets, in the City of St. Louis and State of Missouri, and at ten o'clock a. m. of said day, I will proceed with the taking of the testimony in said cause under the reference to me as Special Master made and entered of record in said Court on the 16th day of February, 1904, when and where you will appear, and each and every of you, and particularly Mr. W. A. Layman, are further notified to produce before me on said hearing at said time and place all books, papers, vouchers and documents in any manner pertaining to or relating to the matter in controversy.

HENRY H. DENISON,
Special Master.

In pursuance whereof I met Messrs. Bakewell and Cornwall, Solicitors for the complainant, and Messrs. Fowler and Bryson, Solicitors for the defendant, at the time and place mentioned in said notice, when the proceedings were adjourned by consent of counsel until the 29th day of June, on which day the taking of the testimony was begun as appears of record.

Statement of the Case.

This case is one of accounting for the infringement by the defendant of the exclusive rights of complainant to the patented combination known as Claim Four of the George Westinghouse patent No. 366,362, for Electric Converters, commonly spoken of hereinafter as "Claim Four."

353 An accounting is ordered to ascertain the damages and profits which the complainant is entitled to recover of the defendant by reason of the infringement aforesaid by the defendant of the exclusive rights of the complainant for the period of time between June 24, 1896 and June 24, 1902.

The defendant admits, p. 13 Vol. I. Printed Record on Final Hearing,

"That the matters and things found and decreed in said suit against the Union Carbide Company are res adjudicata against this defendant."

The following are the matters and things so found and decreed in the Carbide suit:

"The particular construction which is the subject of the fourth claim—the only one involved herein—is suggested as follows:

'It may be preferred in some instances to surround the converter with some oil or paraffin or other suitable material, which will assist in preserving insulation, and will not be injured by heating. This material, when in a liquid form, circulates through the tubes and the intervening spaces of the coils and plates, and preserves the insulation, excludes the moisture, and cools the converter. The entire converter may be sealed into an inclosing case, H, which may or may not contain a non-conducting fluid or a gas.'

"'Said claim is as follows:

'(4) The combination, substantially as described, of an electric converter constructed with open spaces in its core, an enclosing case, and a non-conducting fluid or gas in said case, adapted to circulate through said spaces and about the converter.'

354 Complainant contends that this claim covers a transformer whose surfaces are cooled by means of oil circulating through said open spaces in said core and confined in said enclosing case. * * * The claim here in suit was filed with his original application, and it was never canceled or modified. * * * This claim covers such an enclosing case as will confine the non-conducting fluid, and such open spaces in the core as will permit the circulation of the liquid through them.

Westinghouse, then, was the first to patent such an air-tight closed converter. Does the combination covered by the claim in suit

show patentable invention? If the idea of ventilation be rejected, and the patent be confined to the statement of and claim for the enclosed construction, it embodies at least a combination radically modified from those of the prior art, in order to adapt it to a novel purpose. * * *

In these circumstances, the patentee seems to be entitled to claim the means by which the external and internal surfaces of the heat-producing parts of a converter were cooled by such an arrangement and separation of parts as would permit the circulation about them of oil, and the means for the retention of said oil within and about said surfaces, whereby the heat from the oil radiated to the surrounding air. If there is any doubt upon the question of patentability, the practical and commercial results of this improvement must resolve such doubt in its favor.

It appears that in the early history of the art only small converters were used, and the heat generated in them was dissipated by radiation into the surrounding air. But when the art began to call
355 for converters exceeding 10 Kilowatts in capacity, it was found, as stated by the expert for complainant,

"that the capacity of the transformer increased as the cube of the "linear dimensions, and the heat, if the amount of loss was held "stationary, would increase in like proportions, while the radiating "surface would increase only as the square of the linear dimensions."

Further difficulties were encountered, resulting from the inequality of the conductivity of iron and copper. The testimony herein shows that these difficulties were so serious that for some time it was feared that the practical limit of such transformers had been reached; that experiments were made by grouping, by the use of lower current densities, by filling the cases with oil, and by subdividing the iron and copper parts of the converters by large ducts, and using forced drafts. It was only when, as the result of these experiments, it was found that the oil would circulate through the ducts that any progress was made. Then, as complainant's expert says:

"the problem of making large units became greatly simplified. It "became only necessary to so subdivide the coils and iron as to "expose a uniform surface as compared with the losses in the trans-"former in all sizes, and to provide a case having sufficient external "surface to enable the oil again to give up its heat to the surrounding "air, to make transformers of any desired capacity."

The practical result of the invention in suit, as testified to by complainant's experts, was to so increase the capacity of converters that, while a dry converter, cooled by the natural circulation
356 of air, is limited to 10 Kilowatts, the oil-insulated converters of the patent in suit are commercially serviceable up to 500 Kilowatts."

Westinghouse v. Union Carbide Co., 117 Fed. 496-497-498.

The defendant also admits on said p. 13,

"That it has, since the 12th day of July, 1887, and subsequent to the assignment to the complainant, within the Eastern District of

Missouri, and elsewhere throughout the United States, made, used and sold devices or apparatus which embody the invention or discovery claimed in Claim Four of said letters patent."

Points of Complainant.

1.

That the complainant is entitled to recover of the defendant the entire profit derived from the manufacture and sale of the infringing transformers for the period of time involved.

2.

That if the profit can not be ascertained because the defendant has mingled and confused the profits of its entire product so that they cannot be separated, then the complainant is entitled to the entire profits of the manufacture, or to such reasonable proportion thereof as the master may deem equitable.

3.

That the entire value of the infringing transformers is due to the patented combination known as Claim Four.

357 4.

Defendant is not relieved from the liability to account from the fact that it added something to the patented combination.

5.

Defendant does not deny that it made a profit on the infringing transformers.

Points of Defendant.

The defendant takes the broad general ground that in no event should there be a finding for more than nominal damages. The various points raised by the defendant, whether upon the law or the facts, are really subdivision in testimony and argument of the foregoing general proposition.

They are as follows:

1.

That the Court in its decision in the case at bar, exempted, out of the accounting, transformers having spaces between the coils and between the coils and the core because they had such spaces.

2.

That there is no utility in the patented combination known as Claim Four.

3.

That there is little utility in the patented combination known as Claim Four.

4.

That Claim Four is a limited detail claim, open spaces in the core being the distinctive feature.

358 5.

That defendant has not utilized the patented combination known as Claim Four, to its fullest extent.

6.

That it must appear that defendant realized profit from using the invention of Claim Four over and above what it would have realized by using that which it had a right to use.

7.

That complainant is not entitled in an accounting, under the decree, to all the profit made by defendant for using the patented combination of Claim Four, on its infringing transformers because they involved other claims of the patent.

8.

That neither complainant nor the General Electric Company, its licensee, uses the patented combination known as Claim Four.

The points of the complainant will be considered later in the finding of facts and in the conclusion.

Defendant's Points.

1.

That the Court in its decision in the case at bar, exempted, out of the accounting, transformers having spaces between the coils and between the coils and the core, because they had such spaces.

Counsel for defendant assumes, see pp. 3, 4, 5, 6, 7, 8, 9, 10, 11, Brief, that the decision in this case holding that the defend-
359 ant did not infringe Claim Four in its transformers as changed after the Carbide decision was based upon the fact that such transformers were constructed with spaces between the coils and between the coils and the core adapted for the circulation of oil, and that as the transformers here in question were constructed with like spaces, such construction exempts the defendant from responding in more than nominal damages. I do not so understand the decree. The evidence tends to show that all transformers are built with spaces between the coils, and between the coils and the core, and were so built during all the time covered by this controversy as well as during the time covered by the Carbide case; that such construction is indispensable.

The patented combination of Claim Four does not cover the laminated iron plates of which the core is made, nor the copper wire of which the coils are made, nor the spaces between the coils and between the coils and the core, with which all transformers are

made, yet these necessary features of construction were present in the transformers which were held in the Carbide case to be an infringement of Claim Four, and also in the transformers held to be infringements in this case.

The decree herein did not exempt the transformers, changed after the Carbide decision, because they were constructed with spaces between the coils and between the coils and the core, but because the defendant had, in those transformers closed up the open spaces in the core, and thus destroyed the combination of Claim Four, in its entirety. Had it been otherwise, and had the decree been based upon the ground claimed by counsel for defendant, the transformers involved in this controversy
360 would also, of necessity, have been held not to infringe, and there could have been no decree and no accounting. Indeed, counsel seems to make this claim, and to urge that although the transformers infringed Claim Four in its entirety, yet because the infringing transformers had spaces between the coils and between the coils and the core, the infringement was only nominal and damages must be merely nominal.

It appears conclusively in the record of this case, that the transformers decreed in the Carbide case to be infringements of Claim Four

"had open spaces between the coils and the core and between the coils themselves adapted for the circulation of oil."

See pp. Vol. I, Record on Final Hearing, 72, 73, 74.

It also appears that during the period of time covered by this controversy this defendant and all builders of oil filled transformers constructed the same with spaces between the individual coils and between the coils and the core, adapted for the circulation of oil.

See pp. 78, 79, 81, 82, 84, 85, same record.

So far as the utilizing of electric energy by means of the transformer is concerned, there was, during the entire period embraced in this inquiry, no other process or method known in electrical mechanics for increasing the capacity of transformers, excepting the Westinghouse patent known as Claim Four. The defendant had its choice between the air-cooled transformer of ten kilowatts capacity and the oil-cooled enclosed transformer of the Westinghouse patent of any desired capacity. The mechanical industries demanded transformers of high capacity. The defendant in competi-
361 tion with other manufacturers was obliged to furnish transformers of high capacity. There was no way, then known to the art, to meet that demand but by using the Westinghouse patent known as Claim Four. The defendant chose to use it without license of the owner, and did so until the decision of the Carbide case, after which, profiting by its experience and for the first time, it devised a transformer in all respects identical with the Westinghouse patent known as Claim Four, excepting that the combination of Claim Four was destroyed by eliminating the open spaces in the core.

II.

That there is no utility in the patented combination known as Claim Four.

Counsel for defendant on page 26 of his printed brief says:

"The only testimony in the Carbide case showing marked utility in what is set forth in the Westinghouse patent was with reference to oil cooled transformers, having both copper and iron subdivisions and involving also other claims of the patent in suit. There is no proof in that case of the utility of the subject-matter of Claim Four."

This is in direct variance with the decision in the Carbide case, which is binding on the defendant, and which at p. 496 uses the following language:

"The particular construction which is the subject of the fourth claim—the only one involved—is suggested as follows:

'It may be preferred in some instances to surround the converter with some oil or paraffin or other suitable material, which will
362 assist in preserving insulation, and will not be injured by heating. This material, when in a liquid form, circulates through the tubes and the intervening spaces of the coil and plates, and preserves the insulation, excludes the moisture, and cools the converter. The entire converter may be sealed into an enclosing case, H, which may or may not contain a non-conducting fluid or a gas.'"

It is claimed, as a matter of defense, that there is no utility in the invention. The Patent Office in issuing the patent found that it was new and useful. If the trade believed that there was utility and if that belief created a demand for the invention, and if the infringer supplied that demand by manufacturing the patented article in its entirety, can he escape responsibility for the infringement by undertaking to show lack of utility in the pirated invention or in any feature thereof? Particularly if it appears that the infringer reaped large profits from pirating the invention to supply a natural or artificial or even senseless demand?

Is it not true that infringement itself, so far as the infringer is concerned, admits utility? Is not the infringer estopped from denying utility of an invention which he has pirated in its entirety, and from which he has reaped profits? There can be no doubt upon that question.

The defendant, clearly, would not have infringed had it not believed that a transformer embodying in its construction, in its entirety, the principles of Claim Four of the patent was a new and useful combination or device, that there was a demand for it, and that it could be manufactured and sold at a profit.

The record shows that such manufacture and sale were continued for a long series of years, to the extent of many thousand of such transformers.

363 III.

That there is little utility in the patented combination known as Claim Four.

While it is true as has been adjudged in Vance v. Campbell, 66 U. S. 429, and elsewhere, that

"Unless the combination is maintained, the whole of the invention fails. The combination is an entirety; if one of the elements is given up, the thing claimed disappears,"

yet it does not follow that one who has infringed, by using, manufacturing and selling the combination as an entirety, can defend his unlawful action or mitigate his response in damages, by showing that any one of the elements in the combination is useless or unnecessary.

Under the decision in Whitney v. Mowry, 4 Fisher's Pat. R. 215, by Swayne J. upon the same point,

"The defendant could not be permitted to avail himself of this defense. * * * He should be held to be estopped from insisting on this proposition."

"Every part of the combination claimed is conclusively presumed to be material to the combination, and no evidence to the contrary is admissible in any case of alleged infringement."

Walker on Patents, 3d Ed. Sec. 349.

IV.

That Claim Four is a limited detail claim, open spaces in the core being the distinctive feature.

The defendant on page 15 of printed brief, being No. 6 in the series of the briefs furnished me, says:

"Claim Four is a limited detail claim, open spaces in the
364 core being the distinctive feature thereof, and said claim is to be segregated from the rest of the patent, and the complainant cannot therefore recover the entire profit made by defendant on its transformers, but only that realized by using Claim Four thereof."

"No one can read the decision of the Court of Appeals of the Second Circuit, sustaining the Westinghouse patent here in suit without coming to the conclusion that the Court sustained Claim Four of that patent merely for putting open spaces in the core so that oil would circulate through the core."

I do not understand that Claim Four is limited as above.

The defendant's answer in the case at bar contains the following:

"This defendant admits that the device involved in said suit and used by the Union Carbide Company, the defendant therein, was manufactured and sold by this defendant, and that said suit against the said Union Carbide Company was defended by this defendant and was argued by its counsel, and that the matters and things found and decreed in said suit against the Union Carbide Company are res adjudicata against this defendant."

The defendant, then, by its own admission, is bound by the decision in the case of Westinghouse v. The Union Carbide Company, in its entirety; but an examination of the said decision shows clearly and beyond question that it is not limited "merely for put-

ting open spaces in the core so that the oil would circulate through the core."

On the contrary the decision is very much broader in its scope.

365 The opinion in that case says:

"But the claim here in suit was filed with his original application and it was never canceled or modified. * * * This claim covers such an inclosing case as will confine the non-conducting fluid and such open spaces in the core as will permit the circulation of the fluid through them. Westinghouse, then, was the first to patent such an air-tight, closed converter. Does the combination covered by the claim in suit show patentable invention? * * * In these circumstances the patentee seems to be entitled to claim the means by which the external and internal surfaces of the heat-producing parts of a converter were cooled by such an arrangement and separation of parts as would permit the circulation about them of oil, and the means for the retention of said oil within and about said surfaces, whereby the heat from the oil radiated to the surrounding air. * * *

"The practical result of the invention in suit, as testified to by complainant's experts, was to so increase the capacity of converters that, while a dry converter, cooled by the natural circulation of air, is limited to 10 Kilowatts, the oil-insulated converters of the patent in suit are commercially serviceable up to 500 Kilowatts.

The said patent in suit was simply and only Claim Four, the same which is involved in this controversy.

It would seem that the decision in the Union Carbide Company case was not "merely for putting open spaces in the core so that oil would circulate through the core." but was also for "An air-tight closed converter," which "Westinghouse was the first to patent," and also

"The means by which the external and internal surfaces
366 of the heat-producing parts of a converter were cooled by such an arrangement and separation of parts as would permit the circulation about them of oil, and the means for the retention of said oil within and about said surfaces whereby the heat from the oil radiated to the surrounding air."

And the air-tight enclosing case seems, in the opinion of the Court, to be given the first and most important position among the specifications of Claim Four.

The defendant takes the position that the open spaces between the coils and between the coils and the core are no part of the specifications of Claim Four and are no part of the patented combination; that consequently the transformers which the Court has held infringed Claim Four were not an infringement excepting in the matter of being constructed with spaces in the core.

The defendant seems to claim that infringement of Claim Four, as admitted in the answer, and as found by the Court, cannot be treated as an infringement of Claim Four in its entirety so far as damages or profits are concerned for the reason that the spaces between the coils and between the coils and the core are no part of

the patented combination, and that although they are a feature in the construction of the transformers made by the defendant, and which have been held to infringe, the assessment of damages must be limited to the profits earned by making the core with open spaces, and that such profit is the difference in the expense of manufacturing transformers with open spaces in the core, compared with the expense of constructing the core without the open spaces.

The position thus taken by counsel for defendant is a nov-
367 elty so far as this case is concerned, at least I do not find this question raised at any stage of the Carbide case, and I am not aware that it has been raised in the case at bar, until at this time before me on the question of damages.

In raising this point of defense the defendant loses sight of the fact that Claim Four, in its entirety, is a patent by itself, segregated from and exclusive of the other claims of the patent; and that Claim Four, when segregated from the rest of the patent, is for a transformer complete in every particular, as was decided in the Union Carbide case, that the oil-insulated converters of Claim Four increased the capacity of converters from ten Kilowatts to over five hundred Kilowatts according to the decision of the Carbide case, and that the infringement of Claim Four, in its entirety is admitted and decreed.

"The fact that it has been infringed by defendant is sufficient to establish its utility, at least as against them. Whitney v. Mowry, 4 Fish. Pat. Rep. 207."

Lehnbeuter v. Holthaus, 105 U. S. 96.

In the opinion in this case, as reported in 129 Fed. Rep. in speaking of the defendant's action after the judgment was rendered in the Carbide case, occurs this language:

"After that injunctive order became final, the defendant conformed thereto by changing its transformers so as to close up all the parallel open spaces throughout the core itself, leaving the core one solid mass of iron plates with no open spaces in it, but retaining in its structure the open spaces between the coils and between the core and coils as before."

The specification of the patent in question, No. 366,362, also says

368 "Preferably also the primary and secondary coils C^1 C^2 are separated from each other in a similar manner,"

so that the only distinction between the transformers constructed by the defendant and admitted to infringe, and the transformers which this Court held not to infringe, is that in the latter the spaces were omitted from the core and the core was built up solid.

It seems to me entirely immaterial for this inquiry whether the infringing transformers had or had not spaces between the coils and between the coils and the core. It is admitted that the transformers in question were infringements and the Court has so decreed.

"The defendant's device is constructed at the expense of efficiency which the complainant's device avoids."

Westinghouse Elec. Co. v. Wagner Elec. Co., 129 Fed. Rep. 607.

The above is from the opinion in the case at bar, and refers to the device manufactured by defendant, to avoid infringement by omitting the open spaces in the core.

How then can it be maintained that the open spaces in the core are a useless and unnecessary element in the combination?

V.

That defendant has not utilized the patented combination known as Claim Four to its fullest extent.

If the defendant has so used its infringing transformers, by setting them up with the spaces in the core horizontal, instead of vertical, and for that reason (to use the language of defendant's
369 counsel on page 285 of the record of testimony), "If it carries out very imperfectly, and to a very minor extent, the purposes of the patent in suit" I am unable to see how that fact can be shown to affect the question of profits. And this view is sustained by the decision of the United States Circuit Court in White v. Peerless Rubber M'f'g Co., 111 Fed. Rep. 190, where Buffington, J., says:

"One who appropriates an invention so as to gain imperfectly or to a limited extent the advantages which may be derived therefrom, does not thereby free himself from infringement. Sewall v. Jones, 91 U. S. 171, 23 L. Ed. 275, and cases cited. To the extent the respondent uses White's combination, to such an extent it acquires the full measure of benefit from it. Celluloid M'f'g Co. v. Chrolithion Collar & Cuff Co. (C. C.) 23 Fed. is akin to this case."

If the defendant could have obtained better results by setting its infringing transformers with the spaces in the core vertical, it could not be called a very wise business proposition, or a very ingenious mechanical expedient, to set them with the spaces horizontal. However, on page 243 of the transcript of the testimony, counsel for the defendant says:

"I am perfectly willing to admit that the horizontal space is an infringement of the patent as well as a vertical space."

VI.

That it must appear that defendant realized profit from using the invention of Claim Four, over and above what it would have realized by using that which it had a right to use.

There was nothing in the patented combination of Claim
370 Four which the defendant had any right to use at all, and if the defendant added any feature to Claim Four that fact would not relieve it from infringement, nor authorize it to use that which otherwise it had no right to use.

"The defendant's structures differ in some respects from those of the patent, but have all these parts working together in the same

relation to each other, for the same purpose, and producing the same result. They are altered by the addition of a joint in the motor, and of another spring to help carry it, but not by dispensing with any of the parts; they are improved upon, but not departed from. The defendant's improvements are not made independent of and clear from Sprague's, but upon his; and his patent appears to be infringed by this taking of his invention to so improve upon."

Sprague Elec. Co. v. Union Ry. Co., 84 Fed. Rep. 641.

"The Blake machine has a decided advantage, in the greater simplicity and cheapness of its equivalents. It is difficult to resist the conclusion that the change had no motive or purpose but evasion." * * *

"The valve would be only an addition and an improvement of the machine. The valve, therefore, is, in any view, quite immaterial to the inquiry we are pursuing." * * *

"The appellants having embodied all the ideas of Blake's invention in their machine, the valve which supplemented it, whether good or bad, is outside of the case, and can not affect the result."

Blake v. Robertson, 94 U. S. 728.

"But it can not be seriously denied that Cochrane's invention lies at the bottom of these improvements, is involved in them,
371 and was itself capable of beneficial use, and was put to such use. It had all the elements and circumstances for sustaining the patent, and can not be appropriated by the defendants, even though supplemented by and enveloped in very important and material improvements of their own."

Cochrane v. Deener, 94 U. S. 787.

"Addition to a patent machine or manufacture," says Walker on Patents (page 294, Sec. 347), "does not enable him who makes, uses, or sells the patented thing with the addition to avoid the charge of infringement. This is true even where the added device facilitates the working of one of the parts of the patented combination, and thus makes the latter perform this function with more excellence and greater speed." So in Electric Co. v. La Rue, 139 U. S. 607, 11 Sup. Ct. 672, 35 L. Ed. 294, it is said: "Even if the defendant does use the retractable spring in aid of the torsional spring, it could not thereby escape the charge of infringement."

Brislin v. Carnegie Steel Co., 118 Fed. Rep. 597.

"There can be little doubt that the defendant uses the combination of the claims; that he uses something else in addition is immaterial."

Newton v. McGuire, 97 Fed. Rep. 614.

VII.

That complainant is not entitled in an accounting, under the decree, to all the profit made by defendant for using the patented combination of Claim Four on its infringing transformers, because they involved other claims of the patent.

There is nothing in the Carbide, case by which the defendant is admittedly bound, nor in the admissions of its answer which
372 conclude it, nor in the evidence, which tends to show that the infringing transformers involved other claims of the patent.

The following authorities are controlling as to the recovery by a complainant of profits earned by an infringer, where it appears that the manufactured article derived its entire value from the use of the invention.

Elizabeth v. Pavement Co., 97 U. S. 126; 24 L. Ed. 1000;
Manufacturing Co. v. Cowing, 105 U. S. 253; 26 L. Ed. 987;
Hurlbut v. Schillinger, 130 U. S. 456; 9 Sup. Ct. 584, 32 L. Ed. 1011;
Crosby Steam Gauge Co. v. Consolidated Safety Valve Co., 141 U. S. 441, 12 Sup. Ct. 49; 35 L. Ed. 809;
Wales v. Waterbury Mfg. Co., 101 Fed. 126; 41 C. C. A. 250;
Piaget Novelty Co. v. Headley et al., 123 Fed. 898.

"In Elizabeth v. Nicholson Pavement Co., 94 U. S. 126-139, it is said that 'when the entire profit of a business or undertaking results from the use of the invention, the patentee will be entitled to recover the entire profits, if he elects that remedy.' This language was quoted with approval in Root v. Railway Co., 105 U. S. 189-203. As in the case of the Nicholson patent, so in the case of the Schillinger patent, the pavement was a complete combination in itself, differing from every other pavement, and the profit made by the defendant was a single profit derived from the construction of the pavement as an entirety. Callahan v. Myers, 128 U. S. 617, 665, 666."

Hurlbut v. Schillinger, 130 U. S. 456-472.

373 VIII.

That neither complainant, nor the General Electric Company, its licensee, uses the patented combination known as Claim Four.

The owner of a patent may lock it up in his safety vault, and make no use of it whatever, yet it does not, on that account, follow that one may infringe with impunity.

In such case the infringer might be held to account for profits earned by the infringement, but he could not be held for damages resulting from competition and loss of trade, for the simple reason that the owner is not manufacturing, nor seeking trade.

A question might possibly arise in such case, whether the public good, or the right of the public to the benefit and advantages of a new and useful invention might not be so paramount to the exclusive rights granted by the public to the inventor, that if the inventor refuses either to manufacture, or license others to manufacture, and market the invention, the recovery of the owner of the patent against an infringer should be limited to a reasonable license fee, instead of for the entire profits.

It is wholly immaterial, if true, that neither the complainant, nor the General Electric Company, its licensee, use Claim Four of the

patent. That fact can not excuse the infringer. And it is likewise immaterial that most, if not all, of the sizes of transformers embraced in Mr. Layman's list, are sizes in which the General Electric Co. does not use the invention of Claim Four. The question is did the defendant use Claim Four? and that being admitted, the
374 complainant is not obliged to prove the fact, and the defendant must respond in damages.

"I am of the opinion that the invention of Westinghouse, consisting of a combination of elements, unless anticipated by the prior state of the art, is a distinctive step forward in the progress of electrology, in the light of the immediate recognition which it received by the public. It does not seem to me, under the circumstances, to have been obvious to those skilled in the art."

Westinghouse Elec. Co. v. Union Carbide Co. 112 Fed. Rep. 420.

"The question of infringement is one irrespective of motive. The defendant may have infringed without intending or even knowing it; but he is not on that account less an infringer."

Parker v. Hulme, 1 Fish Pat. Cas., 54.

Finding of Facts.

1.

I find from the evidence that the patented combination known as Claim Four, of George Westinghouse Jr.'s patent No. 366,362, is a separate patent segregated and apart from the other claims of the patent: a transformer complete in itself as an entirety.

2.

That

"The elements of the combination of Claim Four are:

First. An electric converter;

Second. Open spaces in the core;

Third. An enclosing case; and

375 Fourth. A non-conducting fluid or gas adapted to circulate through said spaces and about the converter."

Westinghouse v. American Transformer Co., 130 Fed. Rep. 553.

3.

That each and every part of Claim Four was old, with the exception of the air-tight enclosing case.

4.

Westinghouse made a wholly new combination as described in Claim Four of his patent.

5.

This new combination known as Claim Four constituted an entirely new transformer complete in itself.

6.

This entirely new transformer, complete in itself, was infringed in its entirety by the defendant in its transformers.

7.

That the entire commercial value of the infringing transformers so manufactured and sold by the defendant, at and during the time concerned in this accounting, was due to the combination described in Claim Four of the Westinghouse patent.

8.

That the combination of Claim Four is found in its entirety in the infringing transformers of the defendant.

376

9.

That on page 64 of the transcript of the testimony taken before me, the defendant states that the total volume of its sales for the six years involved in this accounting amounts to $2,314,774.73; that the total sales of the infringing transformers for the same period was $955,271.76; that the total profit of all its sales for the same period was $182,001.02.

10.

That the profits made by the defendant on the infringing transformers were merged in the profits of the entire business, and manufacture, so that the testimony of the defendant showed it was impossible to separate them.

11.

That no separate account of the manufacture of the infringing transformers was kept by defendant.

12.

That the defendant did not know and could not furnish the cost of the manufacture of the infringing transformers, nor even an estimate thereof.

13.

That the business of the defendant as to the manufacture of the infringing transformers was so intermingled and confused with its other and general business that approximate results only are possible.

14.

377 That the defendants admitted in the evidence of the witness, Lyman, p. 334, that it had in its vaults inventories made annually or semi-annually referred to in the testimony of Johannessen, and omitted to produce the same in evidence.

15.

That "No record was ever kept, at any time in the company's history, of the feature of construction involved in this case."

Layman's test., p. 50.

16.

That the profits of the defendant from the manufacture of the infringing transformers, as nearly as it can be "reached through estimates, comparisons and apportionment," is approximately 25% on the net amount of the sales of the infringing transformers.

Johannessen's Test., pp. 82-94;
Foster's Test., pp. 132-138;
Schwedtman's Test., p. 405;
Layman's Test., pp. 302-303-308.

The complainant having elected to sue for profits only, the fact that he introduced no evidence upon the question of his damages, has no bearing whatever upon his right to recover profits; neither can his failure to show the profits derived from his own manufacture of the patented article have any bearing upon that right.

The profit made by an infringer of a patented article depends entirely upon his own action; being the difference between the cost to manufacture and the selling price, and this cannot be increased or diminished by reason of the fact that the complainant's profit from his manufacture is more or less, or nothing.

378 See Crosby Valve Co. v. Safety Valve Co., 141 U. S. 452, 453.

The position of the defendant appears to be that as there was no infringement in using the other elements of Claim Four after it had eliminated the spaces in the core and thus destroyed the combination, consequently it can only be held to account for the profits derived from the manufacture of the core with spaces, as segregated from the rest of the patented combination of Claim Four, notwithstanding the fact that the infringement of Claim Four as an entirety is admitted and decreed.

The defendant's action in making and selling a patented article in defiance of the rights of the owner of the patent was unconscionable and inexcusable. It sought by the tortious use of the patent to enrich itself. One of its defenses in this accounting is that the defendant corporation was largely engaged in the manufacture of other articles as well as of the patented invention, but that the expense of their entire production goes into one general expense account, so that it is impossible to single out the expense of the manufacture of the patented article. This position is treated as follows by the United States Circuit Court:

"This excuse for persons who deliberately seek to deprive their "assignee of his merited profit upon the thing sold is claimed to be "justified by law. If such law prevents a recovery herein, a gross "injustice will follow. The defendants have, for their own gain, "and with full knowledge, injured their assignee, and now conceal "themselves behind their confusion of products. They put

379 "down the price, made the person who had the sole right to "sell lower his price, and then assert that

'there is such complication in our varied manufactures that the expense and profit on the infringing article cannot be determined.'"

Force v. Sawyer, 131 Fed. Rep. 885.

While it is true that most, if not all of the elements of the patented combination of Claim Four were old, yet it is also true that these elements as combined in Claim Four constituted an entirely new and novel structure, a transformer complete in itself, introducing a new principle of operation producing new and novel results of the greatest value, which had never before been obtained in a transformer, increasing by five thousand per cent anything hitherto attained in that line, which practically revolutionized the application of electric energy to mechanical uses; and for which no substitute or mechanical equivalent appears to have been found during the entire period covered by this inquiry.

The Court, it is true, held, in this case, that the open spaces between the coils and between the coils and the core, were not the mechanical equivalent of open spaces in the core. This originally arose upon a motion to punish the defendant for alleged contempt in violating the injunction by manufacturing transformers which had the core built up solid, but which in every other particular duplicated the features of Claim Four.

The Court, however, in its final decision, and referring to the Carbide case, said:

"After that injunctive order became final, the defendant conformed thereto by changing its transformers so as to close up all the parallel open spaces throughout the core itself, leaving
380 the core one solid mass of iron plates with no open space in it, but retaining in its structure the open spaces between the coils, and between the core and coils as before";

and speaking of that mode of construction the Court also said:

"The defendant's device is constructed at the expense of efficiency which the complainant's device avoids".

As I understand the position of the defendant, based upon this decision, it is that, by reason of the fact that the transformers involved in this hearing were constructed with open spaces between the coils and between the coils and the core, and that the Court held that such spaces were not the mechanical equivalent of open spaces in the core; and inasmuch as such spaces between the coils and between the coils and the core are not specified as features of the patented combination known as Claim Four, therefore only nominal damages can be recovered, notwithstanding the fact that it is admitted that the entire patented combination known as Claim Four has been infringed, and that the Court in this cause has so decreed;—this too, notwithstanding the fact that the transformers held to infringe the patented combination of Claim Four in the Carbide case, as well as in this case, were constructed with spaces between the coils, and between the coils and the core.

To my mind it is very clear that the meaning of the Court in deciding the foregoing feature of the case is that the transformers therein considered were not infringements of Claim Four for the reason that the combination of Claim Four had not been
381 maintained in its entirety; that one of the elements of said combination, to-wit, the spaces in the core, having been

eliminated, and the spaces between the coils and between the coils and the core not being the mechanical equivalent thereof, the combination of Claim Four in its entirety disappeared.

The defendant has admitted and the Court has decreed that the defendant has infringed the exclusive rights of complainant to the patented combination known as Claim Four of the said Westinghouse patent No. 366,362; that the complainant recover of the defendant the profits, gains and advantages which the said defendant has derived, received or made by reason of said infringement by said defendant of said Claim Four, and has referred the cause to me to take and state an account of said gains, profits and advantages.

Furthermore the transformer referred to in the Court's decision was neither devised nor used by the defendant until the transformers in question in this hearing had been held to be infringements, and then only in order to avoid infringement, and conform to the ruling of the Court in the Carbide case, consequently, under the decision in Crosby Valve Co. v. Safety Valve Co., 141 U. S. 441, no comparison can be drawn between them to affect the question of profits in this accounting.

Moreover the opinion in the Carbide case, which the defendant is admittedly bound by (see Fed. Rep., Vol. 117, at p. 496), thus alludes to Claim Four:

"The particular construction which is the subject of the fourth claim—the only one involved—is suggested as follows:

'It may be preferred in some instances to surround the
382 converter with some oil or paraffin or other suitable material, which will assist in preserving insulation, and will not be injured by heating. This material, when in a liquid form, circulates through the tubes and the intervening spaces of the coils and plates, and preserves the insulation, excludes the moisture, and cools the converter. The entire converter may be sealed into an inclosing case, H, which may or may not contain a non-conducting fluid or a gas'."

To paraphrase the opinion of the Supreme Court of the United States in Crosby Valve Co. v. Safety Valve Co., 141 U. S., at p. 449 it might be said:

"Taught by 'Westinghouse', and by the use of his apparatus, it is not difficult for skilled mechanics to take the prior structures and so arrange and use them as to produce more or less of the beneficial results first made known by 'Westinghouse', but, prior to '1887', though these old patents and their descriptions were accessible, no 'transformer' was made producing any such results."

I am satisfied that the testimony of Professors Nipher, Gray and Langsdorf, and Mr. George E. Wells, introduced on behalf of the defendant, is wholly irrelevant to the matter of this accounting. Granting all their testimony to be true, and all their conclusions wise and scientific, they do not tend in a single iota to alter the facts that George Westinghouse was the inventor of Claim Four of the patent in question; and that the United States Courts have fully and repeatedly sustained the validity thereof and established its

unquestionable utility; that the complainant is the owner of the same; that complainant's exclusive rights therein have been infringed by the defendant; that defendant has confessed the
383 infringement to the extent of many thousands of transformers; and that the Court has decreed that the defendant must respond in damages.

The opinion of these experts upon the want of utility of Claim Four, when diametrically opposed to repeated decisions of the United States Courts which must control my action, cannot have any bearing upon this accounting, even were they relevant.

So, also, neither the Thompson patent No. 516,850, referred to on p. 196 of defendant's testimony, Prof. Nipher on the stand; nor the Moody patent No. 539,876, referred to by the same witness on p. 197, are competent, in my opinion, as bearing on the question of profits in this hearing. Both are patents which were not before the Court in the hearing on the merits; both were issued years after the patent of Claim Four was issued to Westinghouse, and it is not unreasonable to suppose that both were the products of years of experiment and experience;—of the wonderful advance in the knowledge of electric energy and its application to practical uses,—based, it may be, upon the new era in electrical mechanics, which appears to have been opened by the invention of Westinghouse.

It is, perhaps, not a wise afterthought which cannot improve upon the product of the forethought, but such does not reflect upon or belittle the genius of the pioneer.

Besides all this the infringement had occurred, the liability had accrued, the offense was complete, the remedy was being pursued, long before the experiments of these gentlemen, which were only undertaken in defense of this action.

384 There are discrepancies in the testimony of Mr. Layman which I have been unable to reconcile. He says:

"It is a fact that the profits made on the transformers were not identical in percentage of cost with the profits made on the other business done by the company."

Layman's Test., p. 340.

Yet at p. 332 he says:

"I am unable to distinguish the profits made on the transformers, if any were made, or profits made on the balance of the business done by the company."

On p. 62 he says:

"The best I am able to submit is a statement of total sales of all kinds of apparatus, and total profits for the corresponding period."

To which on p. 63 he adds that he is not able to give any data from the books of the company from which could be ascertained the cost of manufacture of the transformers, nor the profits made on the sales of transformers.

While on p. 296 he says:

"I have absolute knowledge of the fact that they were not the absolute cost of the apparatus."

How the witness could have that absolute knowledge, and yet

profess such absolute ignorance on the question of the cost is not made clear.

If, as Mr. Layman says, the defendant sold certain of the infringing transformers at less than Mr. Johannesen's estimate of the cost, it almost necessarily leads to the conclusion that Mr. Johannesen's estimate of the cost was too high; nevertheless, in one
385 of those selected by Mr. Layman for illustration, he shows that the transformer was sold upon the same basis at a profit of nearly 40 per cent.

It is perhaps interesting to note that the result I have reached in this case, though not exactly by the same method, is almost identical in its apportionment with the finding of the master in Rubber Co. v. Goodyear, 9 Wall. 788 (76 U. S.), which was in all things approved and confirmed by the U. S. Supreme Court.

The method I have pursued in reaching the result is similar to that used and applied by the Circuit Court in the following case:

But in this case neither side could give me the cost of manufacture. The defendant gave the amount of sales of the infringing transformers. The complainant furnished the percentage of profit corroborated to some extent by the testimony of the defendant. I have adopted the defendant's estimate of the percentage of factory cost, and from these data I have been obliged to calculate the flat labor and material, which the defendant professed itself utterly unable to furnish.

"Their entire business was probably done at a loss, but neither they nor their books show that the infringing articles were made and sold at a loss. Because they failed to profit by what they legitimately did, it does not follow that they failed of profit by that portion of their business, which they illegally did. They do not know the expense of the manufacture of the infringing Defiance Machine but they do not show that there was no profit. The complainant has given satisfactory evidence of the cost of labor and material of the Defiance Machines. The number made and sold was 4,024. The cost of such labor and material should have been $5,352.06. The complainant shows that the proportion of
386 other expenses that should have been borne by these machines is $1,165.61; making their total cost $6,517.67. These machines were sold to Sawyer & Co. for $13,389.19; hence a profit is shown of $6,871.52."

Force v. Sawyer-Boss Mfg. Co., 131 Fed. Rep. 884.

On page 392 Mr. Layman says:

"Labor and material is an arbitrary percentage which varies with the expense of operating the business."

On page 393 he says:

"We would be able to arrive at the net price received by the company in corresponding fashion as we have in these schedules.

We would know the labor and material expense and would know the general expenses, and after we would apportion that over all our business alike, as we do, we could then be able to determine whether there was any margin on the labor and material, with the expense percentage added, on the net price received for the transformers."

Now if the defendant "would know the labor and material expense" and "would know the general expenses", and "would apportion that", and "could then be able to determine whether there was any margin", and does all this as stated, there must be some method, well known to the defendant in the general conduct of its business, by which these results are all ascertainable.

Flat labor and material is an arbitrary percentage, factory cost is an arbitrary percentage added to flat labor and material, and based upon it. Profit is in the first instance an arbitrary percentage also added to flat labor and material.

387 Yet the defendant has not only given the master no aid in finding these arbitrary percentages, but has made no suggestion out of its own experience as to any method by which they might be determined.

Consequently, I have been obliged to find these arbitrary percentages as best I could. They are arbitrary; they are at the same time mathematical; they vary with the expense of operation; they are based upon the premises furnished by the defendant on page 64; they are strictly deduced from the evidence as I understand it; and the several determinations of these arbitrary percentages appear in the various tabulations set out hereinafter.

Amount of Recovery.

While the infringement was admitted as well as decreed, the defendant persistently claimed that it was utterly unable to approximate the cost of production of the infringing transformers, or the profits accruing from their manufacture and sale, pp. 62-63, 300-302-322-332, or to separate the cost of the infringing transformers from the cost of the entire product of its manufactory, or to separate the profit made on the infringing transformers from the general profits of the entire business, p. 332; and as the defendant claimed that only nominal profits could be found, and, consistently with that claim, furnished no evidence of any kind establishing a different basis of costs and profits than those attempted to be established by the testimony of the complainant, I have been compelled to come to a conclusion "through estimates, comparisons and apportionments" deduced as best I can from the testimony.

388 In this particular the case at bar furnishes such a parallel to the difficulties of the Master, as well as to certain other features of a case decided in the Second Circuit, that I quote and adopt from the opinion in that case, as being appropriate in this, as follows:

"It is evident * * * that this business was conducted, from the very start, under the most favorable auspices, not as an untried experiment, but commencing after many years' experience, from which the means of making an accurate forecast must have been derived, and was carried on on a large scale, with the best machinery, and an abundance of the best material, with a conceded and growing reputation, with a large market, and wealthy corporations for customers, which the defendants were able to supply often at a day's

notice, and with an increasing demand growing out of the widely acknowledged superiority of the article furnished, as compared with other kinds on the market." * * *

338 (l. c.)

"The sum at which they were sold was easily ascertained, but, to fix the exact amount of expense which entered into the cost of their production, was, upon the plan on which this reference was conducted (and, perhaps, would have been upon any plan that could have been adopted), a work of immense labor and difficulty. We may say, indeed, that it was impossible to fix the exact amount of that expense, as many of the elements which enter into it had no existence in precise figures, and were incapable of being reduced to certain quantities. They were entangled with other and different branches of the defendant's large business, carried on in the same establishment, and their details were mingled with details relating to the cost of manufacture of a variety of other articles. It was, therefore, impossible to arrive at certainty, and a result was
389 reached only through estimates, comparisons, and apportionment".

Troy Iron and Nail Factory v. Corning, 6 Blatchford, 340 (l. c.).

On page 303 Mr. Layman says:

"I think it a general principle in manufacturing business that a company such as ours should not receive less than 25% profits on all its sales, to be in sound manufacturing and financial condition."

This is the exact amount as testified to by both Johannesen pp. 82-94 and Foster pp. 132-138 and as admitted by Layman pp. 302-308, which was added to factory cost for profit.

The amount of the profit on the entire product of the factory was stated by the same witness, Layman, for the period involved in this accounting to be about eight per cent.

This, if true, and upon the basis of Mr. Layman's statement, means that the business of the defendant at and during the time involved in this hearing was not "in sound manufacturing and financial condition", or that the actual profits of the defendant, during the period in question, have been greatly underestimated.

If the statement is correct and the business was in sound financial condition, the profits during the six years involved herein, should have amounted to $500,000, instead of $182,000, the amount given by the same witness.

If $182,000 was the actual profit during that period, then, by the same rule, the business of the defendant was not in sound financial condition. Yet there was no intimation or claim from either side that any such condition existed in defendant's affairs.

390 On the contrary it appears, passim, that the business of the defendant was all the time a growing one; and that, during the period involved in this controversy, the size of the factory was being increased to meet the demands of the trade faster than the business provided revenue to pay for (p. 310).

It appears from the testimony p. 64 that the entire volume of the business amounted to the sum of....	$2,314,774.75
That the volume of the infringing transformer business was	955,271.76
Which is 41.26% of the entire volume of business.	
That the total profit of the entire volume of business was	182,001.02
And as the profit on the transformer business on the basis of adding 25% to factory cost as selling price was	159,211.96

I do not think that the suggestion of complainant's counsel to take 41.26% of the total profits of $182,001.02 is the proper method of arriving at the amount of recovery. Naturally I have had no assistance, upon this question, from the defendant, as it insists that only nominal profits should be allowed.

Mr. Layman testifies, p. 299, that during one year of the period in question, a "very serious manufacturing mistake" was made which cost the company in the rebuilding of the transformers about ninety thousand dollars, as nearly as they were able to estimate it.

But an infringer is a trustee ex maleficio for the owner of the exclusive rights protected by the patent. Root v. Railway Co. 105 U. S. 214; Tilghman v. Proctor, 125 U. S. 148, and a trustee cannot be permitted to use the profits belonging to the cestui que
391 trust as was evidently done in this case, to repair the "very serious manufacturing mistake" of the trustee. It is unconscionable, and not to be permitted, that the cost of repairing "a very serious manufacturing mistake" should be deduced from the profits derived from the manufacture and sale of the infringing transformers. Crosby Valve Co. v. Safety Valve Co., 141 U. S. 454.

The ninety thousand dollars referred to is clearly a part of the profit to which the complainant is entitled; for at page 312 the witness shows that this referred to a "very serious manufacturing mistake" in the infringing transformer business in some one year of the period embraced in this hearing, and, in the language of the witness, "was confined to the interval covered by this inquiry."

The net profit according to Mr. Layman's testimony on p. 64 on the entire product of the factory during the six years covered by the inquiry is	$182,001.02
On p. 299 the same witness says that "a very serious manufacturing mistake" cost $90,000 in the rebuilding of transformers, during the same period. This loss cannot be charged up against the complainant and deducted from the profits. If this sum be restored to the general profits, it gives.....	90,000.00
	$272,001.02
41.26 per cent. of this sum would belong to the complainant, amounting to	$112,227.20

This result is arrived at by restoring the $90,000 to the general profits, which I do not think proper, as the mistake was made in the transformer business, and was of course repaired from transformer profits.

The proper statement in my opinion is as follows:

392

Net profit according to Mr. Layman's testimony on p. 64, on entire product is....		$182,001.02
As the transformer business is 41.26% of the gross business, the amount of this gross profit belonging to the transformer business is		$75,093.63
To this should be added the ninety thousand dollars which the defendant deducted from the profit of transformer business to repair the mistake of the infringer		90,000.00
Making the profit on the infringing transformers belonging to complainant.....	$165,093.63 112,227.20	
		$277,320.83
Even if an average of these two methods is taken the result is.....		138,660.41

Viewed from whichever standpoint this tends to show that the testimony of Johannessen, pp. 82-94; Foster, pp. 132-138; Schwedtman, p. 405; Layman, pp. 302-303-308; that the net profits of the transformer business were, or ought to have been, as they were intended and expected to have been, approximately 25% on the gross amount of that business, was substanially correct.

Upon the theory that approximately 25% of the gross amount of the infringing transformer business enumerated in the schedule at p. 64, to-wit, $955,271.76, belongs to the complainant and must be accounted for by the defendant, the following table No. 1 shows, 1st, The Flat Labor and Material; 2d, Factory Cost 25%; and 3d, Profit 25% separately for each and every of the six years involved in this hearing, without making any allowance for com-

393 missions.

By this schedule the defendant would be held to account for profits in the sum of $159,211.96.

Table No. 1.

25% Profit on Gross Sales of Infringing Transformers at 25% Factory Cost.

	Gross sales of infringing transformers.	Flat labor and material.	Factory cost 25%.	Profit 25%.
1896.....	65,601.82	43,734.54	10,933.64	10,933.64
1897.....	128,244.12	85,496.08	21,374.02	21,374.02
1898.....	148,542.29	99,028.20	24,757.05	24,757.05
1899.....	235,335.78	156,890.52	39,222.63	39,222.63
1900.....	230,732.67	153,821.78	38,455.44½	38,455.44½
1901.....	146,815.08	97,876.72	24,469.18	24,469.18
	955,271.76	636,847.84	159,211.96	159,211.96

Flat labor & material.....	$636,847.84
Factory cost 25%.....	159,211.96
Profit 25%.....	159,211.96
Total.....	$955,271.76

The witness, Johannesen, pp. 82-94 and Foster, pp. 132-138, both, however, state that during the first four years the amount added to flat labor and material for factory cost was 25%, and that the amount added for factory cost during the last two years was 40%.

The following table, No. 2, shows, 1st, The Flat Labor & Material; 2d, Factory Cost 25% for four years and 40% for two years, and 3d, Profit 25%, separately for each and every of the six years involved in this hearing, without making any allowance for commissions.

By this schedule the defendant would be held to account
394 for profits in the sum of $153,491.54.

Table No. 2.

25% Profit on Gross Sales of Infringing Transformers at 25% and 40% Factory Cost.

	Gross sales of infringing transformers.	Flat labor and material.		Factory cost 25%.	Profit 25%.
1896.....	65,601.82	43,734.54		10,933.64	10,933.64
1897.....	128,244.12	85,496.08		21,374.02	21,374.02
1898.....	148,542.29	99,028.20		24,757.05	24,757.05
1899.....	235,335.78	156,890.52		39,222.63	39,222.63
1900.....	230,732.67	139,837.98	40%	55,935.19	34,959.49
1901.....	146,815.08	88,978.84		35,591.53	22,244.71
	955,271.76	613,966.16		187,814.06	153,491.54

Flat labor and material	$613,966.16
Factory cost, 4 yrs. at 25%	96,287.34
" " 2 " " 40%	91,526.72
Profit 25%	153,491.54
Total	$955,271.76

The defendant, however, insists (Layman's testimony, pp. 302-303) that at no time was so low a percentage as 25% added for Factory Cost. Upon this theory the following table, No. 3, at 40% for Factory cost throughout the entire period shows, 1st, The Flat Labor and Material; 2d, Factory Cost at 40%; 3d, Profit 25%, separately for each and every of the six years involved in this hearing, without making any allowance for commissions.

By this schedule which is more favorable to the defendant than the calculations based upon 25% for Factory Cost, the defendant would be held to account for profits in the sum of $143,311.48.

395 *Table No. 3.*

25% Profit on Gross Sales of Infringing Transformers 40% Factory Cost.

	Gross sales of infringing transformers.	Flat labor and material.	Factory cost 40%.	Profit 25%.
1896	65,601.82	39,758.68	15,903.47	9,939.67
1897	128,244.12	77,723.71	31,089.78	19,430.63
1898	148,542.29	90,025.64	36,010.25	22,506.40
1899	235,335.78	142,627.75	57,051.10	35,656.94
1900	230,732.67	139,837.98	56,809.18	34,085.50
1901	146,815.08	88,968.84	36,153.90	21,692.34
	955,271.76	578,942.60	233,017.68	143,311.48

Flat labor and material	$578,942.60
Factory cost 40%	233,017.68
Profit 25%	143,311.48
Total	$955,271.76

There is nothing in the evidence to show whether the 25% profit was to be based upon 25% on the flat labor and material alone, or upon the flat labor and material and factory cost combined.

If upon the flat labor and material and factory cost combined, the account would stand as follows upon the basis of factory cost being 40% on flat labor and material account.

Gross sales of infringing transformers		$955,271.76
Flat labor & material	$545,869.60	
Factory cost 40%	218,347.84	
Profit 25% on combined flat labor and factory cost	191,054.32	955,271.76

Upon the same basis if factory cost is taken as 40% on flat labor and material, and the profit is 25% added to flat labor and material and factory cost combined after deducting commissions of $81,211.61, the account would stand as follows:

396	Gross sales of infringing transformers less commissions.....		874,060.15
	Flat labor and material	499,462.96	
	Factory cost 40%	199,785.19	
	Profits 25% on flat labor and material and factory cost combined	174,812.00	874,060.15

Both of these deductions are so largely in excess of any of the other methods of arriving at the profit, that I am convinced that the true interpretation of the testimony is that the 25% profit is to be calculated upon the flat labor and material account alone.

"An infringer is a trustee ex maleficio for the owner of the exclusive rights protected by the patent; and a trustee who has confused the profits made by the use of the trust property with those made from his own property, and commingled them so that they cannot be segregated, must account for the whole. Lupton v. White, 15 Ves. 432; Hart v. Ten Eyck, 2 Johns. Ch. 108; Central Nat. Bank v. Connecticut Mut. Life Ins. Co., 104 U. S. 54, 26 L. Ed. 693."

Wales v. Waterbury Mfg. Co., 101 Fed. Rep (l. c.) 128.

Under the foregoing decisions, and considering the confessed inability of the defendant to segregate the costs and profits incurred in and derived from the manufacture and sale of the infringing transformers, from the costs and profits of its other large product, there would be justification for finding that the defendant should account for the profit on its entire manufacture. Such hardship upon the defendant I have endeavored to avoid, believing it possible that a more equitable result can be reached through
397 the testimony, even though I have received no aid whatever from the defendant upon this point, it having persistently refused to consider or suggest any other basis for judgment than nominal damages.

I have been unable to determine from the evidence that the estimated commissions on sales are, or were intended to be, provided for as expenses in the percentage added to flat labor and material for factory cost, or that added for profit.

If the commissions on sales are not so provided for as part of the expenses, they should be deducted from the gross amount received on the sales of the infringing transformers.

The following table shows:

1st. Gross sales of infringing transformers after deducting commissions.

2d. Flat Labor and Material.

3d. Factory Cost at 25%.

4th. Profit at 25%.

Upon this schedule the defendant would be held to account for the sum of $145,676.69.

Table No. 4.

25% Profit on Gross Sales of Infringing Transformers at 25% Factory Cost After Deducting Commissions.

	Gross sales of infringing transformers.	Flat labor and material.	Factory cost 25%.	Profit 25%.
	955,271.76			
Com's	81,211.61			
	874,060.15	582,706.76	145,676.80	145,676.79

398 Flat Labor and Material..... 582,706.76
Factory Cost 25%..... 145,676.70
Profit 25%..... 145,676.69

$874,060.15

I am, however, of the opinion that, under the testimony, the Factory Cost should be fixed at 40%.

Accordingly the following table shows:

1st. Gross sales of infringing transformers after deducting commissions.

2d. Flat Labor and Material.

3d. Factory Cost at 40%.

4th. Profit at 25%.

Under this schedule the defendant would be held to account for the sum of $132,433.35.

Table No. 5.

25% Profit on Gross Sales of Infringing Transformers at 40% Factory Cost After Deducting Commissions.

	Gross sales of infringing transformers.	Flat labor and material.	Factory cost 40%.	Profit 25%.
	955,271.76			
Com's	81,211.61			
	874,060.15	529,733.43	211,893.37	132,433.35

Flat Labor and Material..... 529,733.43
Factory Cost 40%..... 211,893.37
Profit 25%..... 132,433.35

Total..... 874,060.15

There has been a controversy between the parties regard-
399 ing the transformers sold to the Union Carbide Company, and which were found, by the Court, to be infringements in the case which is herein always referred to as the Carbide Case. Counsel for complainant claims that the profits resulting to the defendant from the sale of the said transformers to the Union Carbide Company must be accounted for to the complainant.

The defendant omitted the said transformers from the list, as Mr. Layman states on p. 47 "because those transformers had eliminated from them the features of Claim Four of this Westinghouse patent."

These transformers were afterwards added to the list, as appears in the record, and the sale amounted to $15,460.

As the Carbide transformers were sold by the defendant within the interval of time involved in this accounting, and have been decreed to be infringements on the exclusive rights of the complainant, and as the elimination of the features of Claim Four was done in pursuance of and in conformity to the decree of the Court, and as the profits on the sale thereof have never been accounted for to the complainant, and as the defendant admits of record that it is in all respects bound by the decree in the Carbide Case, I was, and still am, of the opinion that the said Carbide transformers should be included in the accompanying list, and the profits accounted for in this proceeding as in the last preceding schedule.

It is in evidence that no commissions were paid on the sale of the Carbide transformers, so that the only question involved is the one of profit.

Upon the defendant's theory of excluding the Carbide transformers from this schedule and from this accounting, the following table shows:

400 1st, Gross sales of infringing transformers after deducting commissions and the Union Carbide transformers.

2d. Flat labor and material.

3d. Factory cost at 40%.

4th. Profit at 25%.

Upon this schedule the defendant would be held to account for the sum of $130,090.93.

Table No. 6.

Profit on Gross Sales of Infringing Transformers at 40% Factory Cost After Deducting Commissions and the Transformers in the Carbide Case.

	Gross sales of infringing transformers.	Flat labor and material.	Factory cost 40%.	Profit 25%.
	955,271.76			
Com's	81,211.61			
	874,060.15			
Carbide Transformers	15,460.00			
	858,600.15	520,363.72	208,145.50	130,090.93

Flat labor and material	520,363.72
Factory cost 40%	208,145.50
Profit 25%	130,090.93
Total	858,600.15

This report is accompanied by four volumes of testimony, two of which are transcripts of the oral testimony taken before me during the three and a half years in which this matter has been under consideration; the other two volumes comprise the tabulation from the books of the defendant, taken before me and compiled under my direction, in order to avoid using a vast number of the defendant's books as actual Exhibits.

401 & 402

These two volumes are to be used together as one. The paging is identical in the two, and each line of the tabulation extends across the corresponding pages of the two volumes when opened side by side.

This report is also accompanied by the exhibits introduced before me by both complainant and defendant.

The premises considered, I have the honor to recommend to this Honorable Court that a judgment be entered herein in favor of the complainant and against the defendant, for the sum of one hundred and thirty-two thousand, four hundred and thirty-three dollars and thirty-five cents ($132,433.35) which I find under the testimony to be the profits of the defendant from the manufacture and sale of the infringing transformers, as nearly as it can be reached, and which I find to be approximately 25% on the net amount of the sales of the infringing transformers, after deducting commissions, and fixing the factory cost at 40%.

The calculations of the same appear in Table No. 5 on page forty-seven of this report.

I respectfully pray this Honorable Court for an order allowing me for my services herein such reasonable compensation as the circumstances of the case, the importance of the controversy, and the labor of the accounting, may determine, and such as this Honorable Court may deem meet and just in the premises.

All of which is respectfully submitted,

HENRY H. DENISON,
Special Master.

Filed July 29, 1907.

403 (*Testimony and Tabulations Taken Before Master.*)

In the United States Circuit Court, Eastern Division of the Eastern Judicial District of Missouri.

No. 4457. In Equity.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY
vs.
WAGNER ELECTRIC MANUFACTURING COMPANY.

Testimony taken at the offices of Messrs. Bakewell & Cornwall, in the Chemical Bldg., St. Louis, Mo., on the 29th day of June, 1904, before Henry H. Denison, Esq., Special Master appointed by this Court, under its interlocutory decree in this cause, on the 16th day of February, 1904.

Testimony begun at 10 o'clock in the forenoon of said day.

Present: Henry H. Denison, Esq., Special Master; Albert C. Fowler, Esq., Solicitor for defendant; Paul Bakewell, Esq., Solicitor for the complainant.

WALDO A. LAYMAN, called as a witness on behalf of the complainant, having been first duly sworn by the Master, testifies as follows:

Direct examination.

By Mr. PAUL BAKEWELL:

Q. Are you the Waldo A. Layman who testified in this case of the Westinghouse Electric & Manufacturing Company vs. Wagner Electric Manufacturing Company, and whose testimony appears in volume 1, page 76, of the printed record which was before the Circuit Court on the final hearing?

A. I have not the record before me.

Q. Here is the record.

A. (After examining record.) I am.

Q. What is your present relation to the defendant corporation, Wagner Electric Manufacturing Company?

A. General Manager and Treasurer.

Q. How long have you occupied that position with the Wagner Electric Manufacturing Company, the defendant in this case?

A. I have been Treasurer since the middle of 1898, and Manager since the 1st of August, 1902.

Q. What was your relation with the defendant corporation, before 1898?

A. I have been identified with the Wagner Electric Manufacturing Company since 1892, in the capacities, successively, of draughtsman, engineer in charge of testing work, Assistant Superintendent and Assistant General Manager.

404 Q. In this case, as appears from the record, one of the exhibits introduced in evidence by the defendant, Wagner Electric Manufacturing Company is marked "Defendant's Exhibit 1, printed record, Union Carbide case;" and was introduced in evidence by the defendant's counsel, as appears on page 31 of Volume 1 of the record in this case.

In the record in the Carbide case, as appears from page 216 to page 218 thereof, is an illustration, description, etc., of a certain electric converter, or transformer, which was before the Court in the said case of Westinghouse Electric & Manufacturing Company vs. Union Carbide Company, as defendant's converter or transformer. It was held by the Circuit Court and the Circuit Court of Appeals, in the said Carbide case, that the transformer illustrated in the "American Electrician" and which is illustrated and described between pages 216 and 218 of the record in the Carbide case, infringed the fourth claim of the Westinghouse patent in suit. In the case at Bar, in the United States Circuit Court for the Eastern Division of the Eastern Judicial District of Missouri, entitled Westinghouse Electric & Manufacturing Company vs. Wagner Electric Manufacturing Company, the same transformer illustrated at page 13 of the "American Electrician" for January 1900 (See Volume 1, page 19, of the printed record in this case) and which transformer is illustrated at page 217 of the record in the said Carbide case, is also the transformer which was before the Court at the final hearing in the case at Bar, and found to infringe claim 4 of the Westinghouse patent in suit.

Having called your attention to these matters, and the records, in the particulars referred to, I now desire to ask you, by reference to the last named transformer, and to the article in the "American Electrician," herein referred to, how many such transformers have been made by the Wagner Electric Manufacturing Company, defendant in this case, since the date of the Westinghouse patent in suit; that is, since July 12, 1887?

Defendant's counsel objects to the question as put, as it should be limited to six years prior to the filing of the Bill of Complaint in this case; section 4921 of the Revised Statutes provides that "There shall be no recovery of profits or damages for any infringement committed more than six years before the filing of the Bill of Complaint, or, issuing of the Writ in such suit or action."

A. I do not understand that the transformer illustrated at page 217 in the record of the Carbide case, is the same transformer that

was involved in this last named action in the Eastern District of Missouri.

405 The transformers primarily under consideration in the Missouri case were constructed differently from those shown at page 217 of the Union Carbide case.

Mr. BAKEWELL: Mr. Special Master, I call your attention to this record. There were two transformers it is true. Here is a stipulation by defendant's counsel, and that was admitted before the Court.

The SPECIAL MASTER: Let the witness finish his answer.

A. (continued). I do understand, however, that the decree in the Missouri case was for the complainant, insofar as the transformers manufactured by the Wagner Electric Manufacturing Company bear the same construction as to spacing of the iron, as shown in this figure at page 217.

Q. Have you read the interlocutory decree in this case?

A. I think I have, although I do not recall it at this moment. If you show it to me I will soon tell you.

Q. I now ask you to read the certified copy of the decree in this case; and also call your attention to the stipulation in Volume 1 at page 19 of the record in this case, and particularly the first two paragraphs thereof. And with that before you, I would ask you to answer my previous question in regard to the number of transformers made by the Wagner Electric Manufacturing Company, defendant in this case, similar to the transformer illustrated at page 13 of the article in the "American Electrician," which is found at page 217 of the record in the case of Westinghouse Electric & Manufacturing Company vs. Union Carbide Company?

A. (After examining papers.) I do not recall having read the decree, but I now know its contents, and have also read the stipulation to which you refer. Do you want this question to cover the entire number during our entire period of operation, or within any restricted time?

Q. I ask you to confine your answer as to the number of such transformers made by the Wagner Electric Manufacturing Company, defendant in this case, since June 24, 1896, up to the present time, which date is exactly six years before the Bill of Complaint in this cause was filed?

A. I am not prepared to answer accurately at this moment, but have in course of preparation at our factory a tabulation, such as you desire. I have before me now preliminary figures which date back to September 21, 1897; but I cannot assert that these figures are absolutely correct, as they only reached my hands in preliminary form this morning, and I desire to check them over, and will then supply this information.

Q. What are these figures you have before you? Are they original entries?

406 A. These figures are tabulations made from our original factory entries; in our business we have a factory record num-

ber for each transformer, and it was from the record of these numbers that I have been having this tabulation made up.

Counsel for complainant states that without waiving his right to inspect the books of original entry from which the alleged tabulation is made up, but, on the contrary, insisting upon that right if he desires to exercise it at a later date, he again repeats the last question and asks the witness to state now the best information he can give as to the number of transformers, such as the ones called for by the last question, which were made by the Wagner Electric Manufacturing Company since June 24, 1896.

A. (After examining memorandum.) I have a record of six thousand five hundred and twenty-four (6524) transformers of all sizes.

Q. Is or is not that a complete statement of all the transformers such as the one called for by the last preceding question, made by the Wagner Electric Manufacturing Company since June 24, 1896?

A. I think this tabulation is not correct, and I would request the privilege of revision. The number may be slightly increased, by virtue of the fact that these dates have not gone back to the dates specified in your question.

Mr. FOWLER:

Q. State how far this tabulation goes back.

A. This tabulation goes back to September 21, 1897; and, further, it includes not only all the transformers manufactured, but those re-built; as quite a number were re-built, owing to defects in them. In order to give a correct tabulation I will have to have this schedule carefully revised, which revision is now in process. I am not prepared now to give this record.

Mr. BAKEWELL:

Q. Have you the original books of entry of the Wagner Electric Manufacturing Company which show the number of transformers like the one referred to in the last preceding questions, which were made by the Wagner Electric Manufacturing Company since June 24, 1896?

A. We have complete books of original entry, showing all these transformers.

Q. I will ask you to produce those books, so I may have an opportunity of inspecting them; and from those records give us a complete list of the said transformers so made by the Wagner

407 Electric Manufacturing Company since June 24, 1896.

A. This record is in the form of a card catalogue, which I will produce, either here or at our own office, as you deem most convenient.

Mr. BAKEWELL: I will suspend the examination on this particular inquiry for the present, and will ask the witness to produce the original records referred to in his last answer, at this office, at a time to be appointed by the Special Master before the closing of this session of the depositions; meanwhile I shall ask the witness some other questions.

The SPECIAL MASTER: There is no objection to taking up another branch.

Mr. BAKEWELL:

Q. Have you read the articles from the "American Electrician" of January 1900, found between pages 215 and 218 of the record in the case of the Westinghouse Electric & Manufacturing Company vs. Union Carbide Co. which has been heretofore referred to, especially so far as the same relates to the Wagner transformer, illustrated at page 13 of the said article in the "American Electrician" and at page 217 of the record in that case?

A. I have.

Q. State whether the transformer sold by the Wagner Electric Manufacturing Company to the Union Carbide Company, and illustrated and described in that manner, are correctly illustrated in that article, and described therein?

A. Substantially so. The picture on page 217 of the record in the Carbide suit, is made up of two photographs, one an internal view and the other an external view; the view of the internal portion being made while that part of the apparatus was outside of the box, and the artist has successfully combined the two pictures, but the proportions are a little out; however, the construction is substantially shown.

Q. State whether or not the efficiency tests given at page 12 of this article in the "American Electrician" (and at page 216 of the said record in the Carbide case) give correctly the efficiency of the transformer sold to the Union Carbide Company, and which are referred to in that article.

A. I believe the efficiencies shown are correct. There were seven transformers in this installation, and the curves probably are average results on the seven units, if I remember correctly.

Q. You say there were seven transformers?

A. Yes, seven.

408 Q. Please state who made the tests referred to in the last question, and found in this said "American Electrician" manner?

A. The tests were made by Mr. Geo. E. Wells, an engineer in the employ of the Wagner Electric Manufacturing Company at the time these transformers were installed.

Q. Where were these tests made, which are referred to in the last question and answer.

A. Preliminary tests were made in the Wagner Electric Manufacturing Company's factory.

Q. In St. Louis?

A. Yes, sir, in St. Louis. But the final tests were made at the plant of the Union Carbide Company.

Q. Which are the tests indicated in the article to which I have referred in my last question?

A. My recollection is, that the tests referred to in the article were made at the plant of the Carbide Company.

Q. In respect to the records that I inquired about a few moments

ago—the original records which you are to produce in order to give us the definite data inquired about—do those records show, not only the number of transformers made by the Wagner Electric Manufacturing Company, but the size of the transformers, the dates of the sales respectively, and the names of the persons to whom the transformers were sold?

A. The record I refer to shows the size, serial number and date of sale; but not the name of the purchaser.

Q. I would also ask you to produce at the next session to which we may adjourn, such other records of the Wagner Electric Manufacturing Company as may give us the names of the purchasers of these particular transformers, made by the Wagner Electric Manufacturing Company, so we may be able to identify these transformsrs ourselves, or make further inquiries regarding the same.

A. These records run through many volumes, there being in the neighborhood of six thousand transformers sold to many people, running through six years.

Q. I would ask you to produce at the next session a record of the transformers which I have inquired about, which you say is contained in the card system of files, and which will show the number of transformers which I have inquired about, which have been made by the Wagner Electric Manufacturing Company since June 24, 1896. I ask you to do this, without waiving my right at that examination or at a later session, to inspect the original card system of files from which this record which I ask you to bring may be made.

I would also ask, and the following request is based upon
409 a discussion had here in the presence of the Master that you also cause to be prepared, to be produced at the next session, or a some later session, a transcript from the books of original entry of the Wagner Electric Manufacturing Company, in relation to all the said transformers sold by the Wagner Electric Manufacturing Company since June 24, 1896, giving the names and places of residence of the parties to whom such transformers may have been sold, the price of the said transformers, the sizes of the transformers, and the places of residence of parties to whom such transformers may have been sold. In this transcript I should also ask that each entry refer to the book and page from which it has been taken.

I make this request for the convenience of all parties, but without waiving my right at a future date to inspect the original books from which these entries may have been taken.

At this point the Special Master adjourned the further hearing of testimony and proceedings until July 5, 1904 at 10 o'clock a. m.

ST. LOUIS, MO., *July* 5, 1904.

Met pursuant to adjournment as above on Tuesday July 5, 1904 at 10 o'clock a. m., present Hon. H. H. Denison, Special Master, Mr. Paul Bakewell Counsel for Complainant and Mr. James Bryson of Counsel for the Defendant. At the request of counsel for Defendant the Master adjourned the further taking of testimony to Tuesday July 12, 1904 at 10 o'clock a. m.

ST. LOUIS, *July* 12, 1904.

Met pursuant to adjournment as above on Tuesday July 12 1904 at 10 o'clock a. m. Present, the Hon. H. H. Denison, Special Master; Mr. Paul Bakewell, Counsel for Complainant; Mr. James Bryson of Counsel for the Defendant; and the witness Mr. Waldo A. Layman being also present; when the following proceedings were had.

WALDO A. LAYMAN in continuation of his direct examination, testified as follows:

Mr. BAKEWELL:

26 Q. When you were on the stand the last time in this office, on the 29th of June, 1904, I asked you to produce at the next session to which we might adjourn, a transcript from the books of original entry of the Wagner Electric Manufacturing Company, in relation to all the transformers I had inquired about in that examination of June 29, 1904, sold by the Wagner Electric Manufacturing Co. since June 24, 1896, giving the names of the parties to whom such transformers had been sold, the price of the said
410 transformers, the sizes of the transformers, and the place of residence of the parties to whom such transformers may have been sold; have you such a transcript with you?

Mr. BRYSON: I want to say, that we are not prepared to produce the names of the parties to whom such transformers were sold. We also object to it as irrelevant and immaterial to the issues here. The patent in this suit expires today July 12, 1904. Now, this being the case, there can be no reason why the defendant should disclose the names of its customers as no injunction could be obtained against them for the use of this apparatus. Moreover, it is our intention to prove here that if the Defendant had not used the patented improvements, he could have used other devices, opened all the art, with the same effect and the same advantage; and, therefore, the Claimant is entitled to no profits and no damages whatever.

Now it seems to us a hardship to compel us to place in the hands of the Claimant a list of the Defendant's customers. The only utility of such a list would be as aid in competition to the Claimant and it would be simply the result of a fishing excursion to obtain the names of other parties against whom to bring suit on other patents. There is nothing bona fide about the inquiry into damages and profits in this case. Now the Master has nothing to do with the origin and history of the infringing device. The only question before him, is the question of quantity. Walker on Patents makes that assertion in Section 742 of the Fourth Edition; and the Court will not permit this question to be propounded to the witness merely for the sake of ascertaining the names of other parties, to disprove this witness' testimony. The Claimant has called this witness as its own witness, and is bound by its answer, and cannot produce any witnesses to impeach him.

We are willing to produce the original books of entry, to enable the Master to verify the transcript which has been here produced in

evidence; but we submit we should not be compelled to furnish to the Claimant a list of customers who have purchased this apparatus from the Defendant.

Mr. BAKEWELL: In the first place, under the certified copy of the Decree which is before your Honor here, we are entitled, as we are under the formal Decree, but specifically under this decree, to have them produce their original books of entry here, in order that we may get exactly the data I have asked for. This matter was thrashed out before your Honor the other day. I have made the inquiry here. The gentlemen spoke of the inconvenience they would have in producing their original books of entry, from which I could get this information to which I am entitled. As a mere matter
411 of convenience to them, more than anything else, I asked particularly what the books showed in this respect and the witness stated. Then I asked him to produce a transcript of the books in this respect, in regard to these particular things. Not only was I entitled to that, but no objection was made to it. They not only admitted that the books showed these things, but they agreed these things should be produced, and for that purpose we adjourned.

Now so far as this gentleman's statement as to a fishing excursion, and bad faith, he is not entitled to make those statements. These are legitimate motives of Counsel taking the depositions, for the purpose of ascertaining the damages and profits to which the Claimant is entitled in this action, and it is the exact inquiry, and all the inquiry, made in all these cases. We must first know what the books show; and I want a complete transcript of the books in that regard.

As to the statement of the gentleman, that they are not bound by the statement of the witness, the Master knows perfectly well what rules of evidence apply in cases of that kind, and it is not necessary for me to discuss that matter here.

I insist upon my question, and respectfully insist that I am entitled to an answer and entitled to all that information.

The MASTER: The matter was laid over until to-day in order that the witness might produce a transcript from the books which contain the information desired; and, as stated at a previous hearing, it was done for the purpose of avoiding the necessity of transporting to this office a large number of books. His statement was, that the information was contained in a great many volumes.

The Court has decreed that the patent has been infringed and has sent the matter to me for the purpose of ascertaining the amount of the damages. I cannot determine that the names of the parties may not be a necessary element in the examination, in order that the facts may be made to appear by other witnesses than the one upon the stand. The order issued to me authorized me to have produced before me all the books of the Defendant bearing upon this question. I shall be obliged to overrule the objection, notwithstanding that anything involved in that inquiry may not be pertinent to this matter. It is impossible for me to determine in advance whether it may or may not be. If I err in this matter, when my report is returned the Court will, of course, correct me.

Mr. BRYSON: I object to this ruling and except thereto; and request the Master to adjourn the further hearing of testimony for the purpose of giving me an opportunity to make a motion
412 in Court for an order compelling the Master to change his ruling on this point.

I will say, that the circumstances here are unusual, and should the names of these customers be now given, the disadvantage to the Defendant will have been accomplished; and the giving in of the final report of the Master will be too late to give any advantage to the Defendant here, should the Master's ruling on these points be reversed.

Mr. BAKEWELL: As to that, I simply say it is unheard of for any such request to be made, and I respectfully request that the Master not grant such request. The Master has been delegated by the Court to do this very thing. The proceedings before a Master cannot be interrupted to take it before the Court, at this stage. It is not like taking testimony before a Notary, who has no authority under the law to pass upon the propriety of questions or the relevancy, competency or materiality of questions. That does not apply to a Master, on final hearing, on a question of damages and profits. The Master represents the Court in this matter. The only way for this matter to be passed upon, is upon exceptions to the Master's report, after the giving in of the Master's report, and not at this stage. I respectfully urge that this last objection be overruled and the proceedings be proceeded with in regular course.

Mr. BRYSON: I do not deny the Master's authority to rule on this matter; but I submit there is authority, where the circumstances are unusual, to refer the matter by an immediate motion to the Court. I ask your Honor's attention to Section 741 of Walker on Patents which says: "If the Master's ruling is unfavorable to the evidence objected to, the evidence will be admitted subject to the objection, and that evidence may be reviewed.
as well as by means of an immediate motion."

The MASTER: But that immediate motion is made in open Court, and not before me.

Mr. BRYSON: I simply ask that this taking of testimony be suspended until I have an opportunity to make that motion. Or, at least, that I be not compelled to give the names of these people until I have had that opportunity.

The MASTER: As a matter of practice, I would not take the statement of Walker, or any one else. My own judgment of the law which controls me, is my only rule of action. I must make my report and return it to the Court. And I know from a previous experience what Judge Adams' ruling would be if I should present the matter to him with suggestion for instructions. He would
413 say to me, "The Decree is your instruction as to what your duties are."

Mr. BAKEWELL: I request that we should proceed.

Mr. BRYSON: I am not relying entirely on what Walker says, but on the common sense of the thing. Here is a case where, if we give these names, the damage is done. The Court may not get at it in

any way after that to repair that damage; and, therefore, I ask that the Court be given an opportunity to pass upon it now. The circumstances are unusual. I have here a considerable list of cases where the Court has held that under unusual circumstances this could be done. I will ask your Honor to look at these cases before my request is denied.

Mr. BAKEWELL: It seems to me the proposition is a very simple [*now*]. I am entitled to these books here and now.

The MASTER: It seems to me the proposition is a simple one, and that Counsel is entitled to have the question answered; and I can take no action except to overrule the objection. But if the Counsel has authorities which he would like to have the Master examine before ruling upon the question, I have no objection to laying the case over until tomorrow, for instance, in order that I may look at those authorities, if you have some you wish me to see. Otherwise, I shall be obliged to overrule the objection instanto. If you and Mr. Bakewell can consent to adjourn until to-morrow morning, I am willing to do that.

Mr. BRYSON: I have excepted to the Master's ruling, and ask for an opportunity to get the matter before the Court, before the question is answered.

Mr. BAKEWELL: Here is the Decree, showing that I am entitled to the production of these books, etc. Here is the answer of the witness showing that the books contain what I am asking for.

The MASTER: It is not necessary for you to argue that. The matter is perfectly clear to me. The books, I understand, will show everything you have included in your question; the abstract which the witness has furnished was taken from the books by agreement for the purpose of avoiding the necessity of bringing in a large quantity of books which were kept by the Defendant, and to my mind the only thing to be done, is to proceed with the hearing. But this objection being urged, it seems to me it raises no question, certainly not to my mind, that would require me to sustain it.

414 The fact that the patent expires to-day has nothing whatever to do with the damages which may have accrued in the past, from the time the Decree requires the damages to be assessed.

Now as Counsel for Defendant has suggested that he has authorities he would like to have me examine before making a final ruling on this matter, personally I would be perfectly willing to examine them, but can only do that by adjourning until to-morrow, in order to go to the Library to look the matter over. If Counsel for Claimant agrees that that may be done for my information, I am willing to do that; otherwise, I will rule that the proceedings must proceed.

Mr. BAKEWELL: I claim to have some familiarity with the practice prevailing in these cases. I have been put to a great deal of inconvenience in this matter and it is very inconvenient for me to put this off. All this time since the 29th of June there has been delay on account of Mr. Fowler's desire to have this thing postponed. I have other engagements ahead and I will be put out very much if this matter must go over until to-morrow. The proposition is so plain, I think we ought to proceed.

Mr. BRYSON: The witness cannot produce these names today.

Mr. BAKEWELL: I don't know whether he can or not. If he cannot, he has not kept his agreement with me.

The MASTER to Mr. Bakewell: Point out the place in the record where the agreement was made between Counsel that this abstract should be furnished.

Mr. BAKEWELL: I will read it to you: "I would also ask, and the following request is based upon a discussion had here in the presence of the Master, that you also cause to be prepared, to be produced at the next session, or at some later session, a transcript from the books of original entry of the Wagner Electric Manufacturing Company, in relation to all the said transformers sold by the Wagner Electric Manufacturing Co. since June 24, 1896, giving the names and places of residence of the parties to whom such transformers may have been sold, the price of the said transformers, the sizes of the transformers, and the places of residence of parties to whom such transformers may have been sold. In this transcript I should also ask that each entry refer to the book and page from which it has been taken.

I make this request for the convenience of all parties, but without waiving my right at a future date to inspect the original books from which these entries may have been taken."

415 Mr. BRYSON: It is not in the record that he agreed to produce them.

Mr. BAKEWELL: This discussion occurred in the presence of the Master and he will remember that Mr. Fowler and the witness both agreed to conform to this request.

The MASTER: It is very clear what that calls for and what is to be produced. The witness may answer the question.

Question 26 read to the witness:

A. I have a partial transcript, running from June 24, 1896, up to July 1899. This is about 3/5ths of the entire list. It is made up of some sixty typewritten pages and it will extend when filled up, to about September, 1901, at which time the Defendant discontinued entirely the construction of this patent, employing another form of construction, which the Courts have since held was not an infringement of the patent at all. While we have built all the same sizes of transformers, we have not used the patent.

I was asked, at the last meeting, to produce the card record at this office; but in view of the fact that I found in making up the record it was very inconvenient, and would entail a great deal more time to use the cards, I substituted other records of the Wagner Electric Manufacturing Co., which will show the record thoroughly. I will submit a sample of the card to which I referred, and beg to say in connection with that, that the card gives a general order number here but gives only a single transformer furnished on that order.

(The witness here produces the sample card above referred to.)

I have here another general book of the company, which is the full record of the transactions in every case.

The transcript, so far as it goes, does not show two things asked for in the question: One is the date of the sale; and the other is the names of the customers. The date of the sale was omitted partially inadvertently; the idea I had in mind being, that Counsel for Claimant desired a reference of some sort which would afterwards enable him to compare with the original books of entry, and that reference is sufficiently complete in the serial number of the order, those being in arithmetical sequence on our record books.

I did not incorporate the names of the customers for the reason that I desired to ask the Master to defer the production of this record, pending his passing on the question of whether they were relevant to the proceeding, as the Wagner Electric Manufacturing Co. expected to establish that no damages had been suffered under this patent.

416 The record as made incorporates all sizes of transformers made by the company, which employed the construction of the fourth claim of the Westinghouse patent. These sizes extending from 1½ Kilowatts, type G, up to and through all the larger sizes. I believe it is an accurate matter of record in the Union Carbide case, that the complainant in this action did not claim the patent to be a contribution to the art for transformers of 10 Kilowatts, or smaller sizes, and I therefore felt that there was the further reason on this account of not producing the names of the customers for the smaller sizes of transformers, where the construction of the patent was employed, not for the purposes of the patent but as a matter of mechanical convenience in construction. However, as the transformers in their construction come under the terms of the patent, I have incorporated them in the list of transformers here shown.

I have produced one of the general order books, and had intended to state to the Master that I could produce all these books for the inspection of the Master, at any time desired; and desire to urge the withholding of the names of customers, until a subsequent date; these names to be then produced if the Master finds that the defense had not shown no damages, and the complainant, for the purpose of establishing damages, was entitled to the names.

Mr. Bakewell: I respectfully submit, may it please your Honor, that this witness, according to his own statement, has himself undertaken to pass upon the questions which should be passed upon by the Master; and not only that, but has undertaken deliberately to break the agreement made at the last session, which was largely done for the convenience of the Defendant. And upon his own admissions, not only is this so-called transcript incomplete, in that it does not give the number of transformers inquired about, but it is also incomplete in that it does not give the names and places of residence of the parties to whom the transformers were sold. In view of this, and as the alleged transcript is not a transcript such as the one asked for at the session of June 29th, 1904, and such as the one then agreed to be produced, I now ask that the witness be instructed to produce all the books or cards of original entry inquired about at the last session, authority to compel the production of which is given by the Decree in this case, so that the Complainant

may obtain, without argument from the witness, and without
opinion of the witness as to what he should or should not pro
all that information and data to which the Complainant is ent
under the Decree entered in this cause, which information confes
the witness has not produced.

417 Mr. BRYSON: I object to that unless the books requir
be produced are more specifically described so the witnes
tell what to produce.

Mr. BAKEWELL: The particular books of the Wagner Ele
Manufacturing Co. which contain the entries as to the transfor
enquired about, lie peculiarly within the knowledge of the Wa
Electric Manufacturing Co. and of this witness, as appears fro
record of the testimony already taken. These books of orig
entry do contain the information asked for, as appears from
admissions of the witness, which he has made before the Ma
And it is in regard to these books of original entry, which co
the data relating to the transformers found to infringe this pa
and referred to in my examination on June 29, 1904, that I
that the witness be compelled to produce.

I want all the books, or cards, or whatever the witness may
them, which are matters of original entry, and which show
record of transformers, such as those inquired about of the wi
at the last session of June 29, 1904, made or sold by the Wa
Electric Manufacturing Co., since June 24, 1896, giving the n
and places of residence of the parties to whom such transformers
have been sold, the price of said transformers, the size of the t
formers, and the dates of sale of each of such transformers.

The character of transformer inquired about, and concer
which I desire information, is set forth in my question to this wit
put to him at the session of June 29, 1904, beginning particul
with question six on page two of this deposition; and then to
questions relating to the same matter on pages 3, 4, 5 and 6 of
deposition of this witness, taken in this office on June 29, 1
And relates to the particular type of transformer found to hav
fringed the patent in suit, by the Court in its Decree in this

Mr. BRYSON: I object to such portion of this request as relat
the names and addresses of the purchasers of such transformers,
give notice that at the proper time a motion will be made before
Court for an order to the Master to reverse his ruling as to the
priety of the production of the names and addresses of
customers.

Mr. BAKEWELL: Counsel for Complainant in addition to
request already made, calls the attention of the Master to the cert
copy of the Decree in this cause, and also to the order in this De
upon the Wagner Electric Manufacturing Co., its Directors, Offi
Attorneys, Clerks, etc.—this witness appearing to be an of

418 of said Company—which Decree, among other things
in reference to these Directors, Officers, etc., that they
hereby directed to attend before said Master from time to tim
required and produce before him such books, papers, vouchers

documents, and submit to such oral examination as the Master may require."

The WITNESS: I would like to ask the Master whether the production of the books asked for by Counsel for Complainant is for the inspection and use of the Master, or whether for the use of the Counsel for Complainant? And, as a witness, I desire the Master to understand that I have not declined to produce any of the records of the Company which the Master may desire to inspect, for the purpose of verifying the transcript as offered to-day in testimony, but have objected to incorporating in this transcript the names of customers, on the ground that such a transcript could become in a certain measure public property and expose the confidential relations of the customers of the Wagner Electric Manufacturing Co. to its trade; and the exposure of such information we regard as not being essential to the purpose of this inquiry since we freely submit to the Master all additional information in addition to the transcript, which he may desire to inspect.

Mr. BAKEWELL: Counsel for Complainant objects to this statement of the witness, and submits it is going entirely beyond the province of this witness, who does not seem to recognize his duty as a witness, but undertakes to impede the progress of this cause and prevent counsel for Complainant and the Master, but especially Counsel for Complainant, from obtaining that information which he is entitled to have.

Counsel for Complainant also calls attention of the Master to the fact that, as the Master is aware, the witness was requested to produce a transcript giving the information asked for, and that the witness and defendant's counsel agreed that the same would be produced; that the information asked for has not been produced by the witness, on his own admission; and one of the reasons for not producing the information asked for by the Complainant's counsel, is stated by the witness to be that he has taken upon himself to determine a priori what should or should not be produced at this hearing, not only contrary to the law but contrary to the agreement made before the Master at the session of June 29, 1904; and by reason of which understanding the adjournment was then had; and counsel for complainant now further states that there is no such thing as a partial record, giving the information requested solely to the Master, and to the exclusion of complainant's counsel. Counsel for complainant is entitled fully to this information; entitled not
419 only to the number of transformers made and sold by the defendant corporation but to the date when the same was sold, and to whom the same was sold, and also the names and places of residence of purchasers, in order that full inquiry may be made, and every reasonable test made as to accuracy for the purpose of ascertaining not only the correct number of infringing transformers so made and sold, but in order to ascertain the actual profits which the defendant may have made and which the Complainant is entitled to recover in this action. Complainant's counsel submits that the witness has gone away beyond his province in making the statement he has made on the record. The witness is here to answer

questions and not to ask them, or to give us his views as to what is proper or improper, or relevant, competent or material to this inquiry. The Defendant Company stands before this Court as an infringer of the rights of the complainant, and under the Decree of the Court the Complainant is entitled to a full inquiry. If the Defendant has seen fit to infringe Complainant's rights, the Defendant must suffer the consequences.

The MASTER: The request of Counsel for the Complainant, for the production of books and papers, as placed upon the record, is sustained; and the Defendant, and its Officers and Agents, is required to produce the books, papers, cards, vouchers and documents called for in the request of Complainant.

The MASTER to the Witness: When can that be done?

The WITNESS: To-morrow.

Mr. BRYSON: I except to so much of the last order of the Master as requires the production of the names and addresses of the persons to whom the transformers referred to were sold.

The MASTER: The objection is overruled and the witness is ordered to produce before the Master the books and papers specified, to-morrow morning.

At this point the further hearing of testimony was adjourned to Wednesday, July 13, 1904, at 10 o'clock a. m.

ST. LOUIS, MO., *July* 13, 1904.

Met pursuant to adjournment as above on Wednesday July 13, 1904, at 10 o'clock a. m., at the same place, present the Hon. H. H. Denison, Special Master; Mr. Paul Bakewell, Counsel for the Complainant; and Mr. James Bryson, Counsel for Defendant. Also the witness Mr. Waldo A. Layman. When the following proceedings were had:

420 The MASTER: Questions such as asked yesterday, compelling the defendant to give the names of parties, purchasers are treated indirectly in some cases, and I find that it is held that in a preliminary examination, where a patent or infringement, or both, are in dispute, and the question is before the court as to whether there is a valid patent and as to whether there has been an infringement, the defendant is not obliged to disclose the names of parties with whom he has dealt; for the [simply] reason, that one infringement is just as good as a dozen; and if one infringement is established to the satisfaction of the Court, it creates a cause for injunctive relief. But after both the patent and the infringement have been established by the decree of the court, and the matter goes to a Master for the purpose of ascertaining damages, then the defendant stands in the attitude of an ordinary wrongdoer, and all his acts in respect to his act of infringement of which he may be guilty, are subjects of inquiry upon the subject of damages. And I think that as in the case of any wrong-doer, he has no privilege then to conceal any portion of his evidence. That was the view I took yesterday, without examining the authorities, and I find that the authorities sustain me in that position.

The examination of the witness WALDO A. LAYMAN is resumed by Mr. Paul Bakewell.

27 Q. What books of original entry, such as those called for by me yesterday, and ordered produced by the Master, have you produced this morning?

A. I have the entire series of books of original order entry, which I think show all the information asked for yesterday.

28 Q. Do these books show the number of transformers sold by the Wagner Electric Manufacturing Company since June 24, 1896, being the kind of transformers inquired about on your first examination on June 2, 1904; and also show the dates of the sales, the names and places of residence of the parties to whom the sales were made, the sizes of the transformers respectively, and the prices at which they were sold?

A. They do.

29 Q. Please turn to the first one of these books showing the sale of such transformers on June 24, 1896, or the earliest date of sale of such a transformer, either on June 24, 1896, or thereafter?

Mr. BRYSON: I object to such parts of this question as call for testimony concerning infringing transformers made prior to the 13th day of July, 1897, when, as shown by the record in this cause, the defendant first received notice of the existence of the
421 patent in suit, and of the complainant's claim of infringing thereof.

Mr. BAKEWELL: We have a right, under this inquiry, to ascertain all the transformers made which infringe the patent, irrespective of the date of the infringement.

The MASTER: I do not remember the date, and I do not know whether that comes within the six years rule in which a recovery can be had.

Mr. BAKEWELL: Six years from the filing of the bill, and the bill was filed June 24, 1904. This question goes to June 24, 1896.

Mr. BRYSON: I have certain authorities which show that the Complainant must show that he has marked the patented article made by him, or notified the defendant of infringement thereof, and recovery cannot be had except on articles manufactured after such notice was given.

The MASTER: That is a matter which should have been presented in the Circuit Court at the preliminary hearing, preliminary to the issuance of a decree. The Court there has found an infringement. I cannot find there was none. I cannot determine as to the time there was an infringement. If the Court has declared there has been an infringement, and that the patent is valid, and recovery is to be had from a certain time, I cannot entertain any objections which will raise before me the question of notice, either as to the validity of the patent or the date of the infringement. Those are matters which are not in my jurisdiction. My duties are narrowly defined by the Court. The objection will have to be overruled.

Counsel for the defendant excepts to the ruling of the Master.

A. I have this book before me open at the first sale made on that exact date.

30 Q. Please state what the volume is, and the page, to which you refer?

A. The volume is the Wagner Electric Manufacturing Co. General Order Book No. 5. The date of the order is June 24, 1896. The sale number of the order is 4046. The name of the customer is El Paso Electric Light Co. The place of residence i Colorado Springs, Colo. The quantity of transformers, twenty. The size of the transformers, twenty light. Type D. The net price received by the Company, $364.77.

31 Q. In the same way, please give the full data of the next sale, understanding that in every question I am inquiring
422 about the particular kind of transformer made by the Wagner Electric Manufacturing Co., and sold, which embodied the construction contemplated by my question in my examination of you on June 29, 1904. I make this question thus full, because my future questions will be brief, with a view of getting this data?

A. The next order is No. 4047 of the same date, June 24, 1896. Sale to the Egypt Electric Co., Cairo, Ill. The sale consisted of one sixty light, type D, transformer. The price received by the Company was $45.

31 Q. Next I am making my questions brief. What I wish is this data giving the name of the customer, place of residence, date of sale, the number of order, price received, etc.

A. Order No. 4048, date June 24, 1896; customer W. W. Cantine, Alliance, Ohio; one, three hundred light type D; one sixty light type D; three candle light; price $194.40.

32 Q. Give the data of the next sale of such transformers?

A. No. 4049; same date, customer Central Electric Co., Chicago, Ill.; one, thirty light type D; one, sixty light type D; one, one hundred and twenty five light type D; the order does not show the price. There is no price shown on this order and I will have to refer to other records to get that.

33 Q. You say no price appears on there?

A. No, sir, no price appears on this order, although the records show that the shipment was made.

34 Q. What record will show the price? I understood that the record you have produced would show the price in each instance?

A. I will have to refer to the ledger of the company, and secure this amount from the ledger of the company.

I have not examined these books personally, but according to the rules of the company this book should have the price in it.

The MASTER:

35 Q. If that is not on the page, it is a clerical error?

A. Yes, sir a clerical error in the factory's system. According to the rule of the company this record should be complete.

Mr. BAKEWELL:

36 Q. Will you get and produce the data that is missing, as to

the price or amount paid for these transformers in this order No. 4049?

A. Yes, sir.

37 Q. Waiving the data as to the amount or price of these
423 transformers, I will ask you to proceed to the next order in this record book, relating to the same transformers inquired about?

A. Order No. 4050; date June 24, 1896; customer P. D. Beckwith Estate, Dowagiac, Mich.; four, seven and a half K. W., type D; three, fifteen K. W.; price received by the company $810.

38 Q. Please give us the next order?

A. Order No. 4051; date, June 24, 1896; same customer. One, hundred and fifty light type d.

eighty light type D; one, one hundred light type D; one, one

39 Q. If I am not mistaken, up to the present time, in reading from this order book in respect to the sales of transformers, where the order and sale is to a certain customer, of more than one transformer, you are giving on the record the total amount of the bill to the customer representing the amount paid to the Wagner Electric Manufacturing Co. But you are not giving the separate price for each particular transformer sold to such customer. That, however, is not satisfactory to me; as I want to know in each instance the price received for each transformer sold to any particular customer.

With that understanding, I must ask you to go over the record again, and where the order book shows the sale of more than one transformer to a particular customer, to identify that transformer by its size and type, and to give the price charged and paid for such transformers. Otherwise, I am not getting the data I desire to have, and which my questions call for.

A. I might also say in this connection that I have been giving the net price received by the company after the payment of commission to the agent who made the sale.

40 Q. That being true, I want to know in each instance the amount charge- to the customer by the Wagner Electric Manufacturing Co. for any particular transformer sold; the amount of the commission paid to the agent for the sale; and the net amount received by the Wagner Electric Manufacturing Co. in the sale of each one of these particular transformers. With this understanding, I must ask you to go back to the first sale which you have referred to in the record, and give me this particular data?

A. The first order is No. 4046; date, June 24, 1896. The name of the customer El Paso Electric Co., Colorado Springs, Colo; twenty transformers of twenty light, type D; billed to the customer at $18.90 each; commission paid to the salesman $40.53 net price received by the company $364.77.

41 Q. Give the next order?

A. The next order No. 4047, is complete as given be-
424 fore.

42 Q. The next?

A. The next order, No. 4048, June 24, 1896, W. W. Cantine;

Alliance, Ohio. The face of this order does not show the subdivision of prices, so that I cannot distinguish what the prices on the individual sizes were. The price of the sixty light unit seems to have been put in at $36 to the customer. The price on the one, three hundred light, and three, ten lights, seems to have been put in at $180 for the combination, making a total billing price to the customer of $216, with a commission of $21.60 to the salesman and a net price to the company of $194.40.

43 Q. Is there any record which you have which would show the prices charged for each one of these transformers?

A. I could determine that only by looking up the day book entry of the billing. This account seems to have been billed in three items and it is possible that these bills will show the individual prices, although I do not anticipate that it does; as frequently orders are taken where the price is so much on a lump contract, and individual prices are in such instances, according to the practices of the company, not specified on the orders, are not quoted to the customer, and do not appear anywhere in the records of the transaction.

44 Q. Well, the price for each transformer of the same size would be the same, would it not?

A. The prices for each transformer of the same size would be the same.

45 Q. So if there were ten transformers of the same size, sold to the same customer, each of those ten transformers would represent one-tenth of the price of the sum total price for the ten transformers?

A. That would be true if all the transformers were of the same sort. But if there were several transformers, all of different sizes, and a lump price paid for the entire order, it would not be shown anywhere in our records what the prices for the individual transformers would be.

46 Q. Yes, but in order that we may come to some definite understanding about this—I may have misunderstood you, but I understood from the last order you read, that the price of one particular transformer could be ascertained, but the price of the other transformers, all of which are of the same size, could not be ascertained except in a lump sum?

A. You are mistaken about those transformers all being of the same size. One is very large and the other small, and the price is given only in a lump sum.

47 Q. Are you prepared to state, as one thoroughly con-
425 versant with the business of the Wagner Electric Manufacturing Co., when you see before you a lump sum on that order for a number of transformers, some of one size, and some of another, what portion of that lump sum would be the price for one transformer, say the one of the larger size, and what would be the price of each of the transformers of the smaller sizes?

Mr. Bryson: The question is objected to as incompetent, irrelevant and immaterial, the matter for ascertainment here being the

profits actually made by the defendant, and not what damages or profits might have been sustained, in the opinion of the witness.

Mr. BAKEWELL: I am not asking for what damages or profits might have been sustained in the estimation of the witness. My inquiry just now is more particularly addressed to the question of profits made by the defendant corporation. For the present at least, I am not concerned with the damages suffered by the complainant. In as much as the witness, who comes from the camp of the enemy, has already stated on the record, as I understand him, that the records of sales of these transformers as kept by the Wagner Electric Manufacturing Co. are in such form that he may not be able to ascertain, and certainly cannot ascertain from this particular record before him, in the given case, the price at which certain, particular transformers embraced in that sale were sold, and can only get at it from the lump sum, I respectfully submit that the question I ask is a proper one, as it is the only way by which it can be ascertained at what price the defendant company sold the particular transformers of a particular type.

In order to ascertain the profits made by the defendant in the sale of these transformers, one of the things which the complainant is entitled to recover in this action, it is necessary for the complainant to know the prices at which transformers of various sizes were sold by the defendant corporation, as that is one of the elements which will enter into the determination of the question of what profits the defendant corporation made on these transformers respectively. The cost of manufacture of each one of these transformers, or each transformer of a particular type or size, is another matter which can be inquired about at another stage.

But I am now concerned with ascertaining, as nearly as it is possible to do so, the price at which each particular transformer of a particular size and price, was sold. For that reason
426 I respectfully submit that the question put to this witness is a proper one.

The objection is overruled.

Counsel for defendant excepts.

A. I think this record will show, in the face of other orders, what the ratio of the prices as between the various sizes is, and from that ratio as developed from these several orders, it would be possible to reasonably closely approximate the prices which Mr. Bakewell asks for. But from the face of this book (indicating), and from memory of any record I know of, I do not know that I can get absolutely the price. But it seems to me an approximation can be made from these various orders, as they run along, which will be sufficiently satisfactory to establish a ratio upon which that lumping amount can be divided up. But it will require some study of these prices as we go along.

The MASTER: I do not suppose Mr. Bakewell is particular how you get at it.

The WITNESS: It strikes me, as we have started out here, this matter will be of considerable duration.

Mr. BAKEWELL: It will be tedious but I am going to do my duty to my client. I am going to get that information.

48 Q. Have you price lists for those different years?

A. I don't know whether we have price lists or not. I will have to make search for them. I had no connection with the mechanical part of the business during those years. I am getting my information, as to what you are seeking, as you are getting it, from the records, and for the first time.

49 Q. At the time these sales were made, were you connected with the company?

A. Yes, I was connected with the company.

50 Q. What department?

A. With the manufacturing department.

51 Q. Had you any connection with the prices whatever?

A. I had no connection whatever with the prices at which these articles were sold.

52 Q. What I want to get at with regard to these items is, for instance, where two or more transformers were sold, and this record book before you shows only a lump sum, then the condition is this: That we have the size of the transformers, the type of the transformers, the total charge to the customer, the commission to the agent, the net sum received by the Wagner Co. after paying the agent. Now where there is nothing but a lump sum
427 given in an order for a certain number of transformers sold, it is immaterial to me how you reach the conclusion, but I would like to have some data, as the statement of you or your company, that of a certain sum received for a certain number of transformers in a particular order, a certain portion of that sum represented the price of one transformer, and a certain portion of the sum represented the price of another transformer, etc., etc.

Mr. BRYSON: In view of the last testimony of the witness, the foregoing testimony and the last question are objected to as calling for incompetent evidence, since the witness has no personal knowledge of these entries upon which this testimony is based. I do not see how a man can testify about these orders when he did not know anything about them at the time.

The MASTER: The witness is asked if he has any means of information as to how these amounts were apportioned among the different transformers.

The objection is overruled. If the witness has any knowledge of his own outside these records, he can disclose it. If he has not, he is simply giving his testimony from these records. These records are the information, as evidence of the transactions of the company. It is perfectly competent for this witness to explain those records, so far as he can, for the benefit of the Master; and simply the fact that he had not a personal knowledge of each one of these sales, is not a reason that his testimony should be excluded.

Counsel for defendant excepts.

Previous question read.

A. As I said before, I think by going through these orders we

can arrive at a price list which will cover all the various sizes, and, so far as I am aware, that is the best way we can get at it. There are sales in here of all the various sizes made, and as these are types of transformers no longer manufactured by the company, and no longer sold by the company, this is information to which the current price lists have no application; and I would have to make up price lists from the prices entered in this book, and such price lists would be special.

53 Q. Has it not been the practice of the Wagner Electric Manufacturing Co. to print from year to year and send among its customers, price lists of these various types of transformers?

428 A. No, sir. We never printed price lists.

54 Q. Don't you have price lists?

A. We quoted prices by individual typewritten letters in a great many instances.

55 Q. It would not be a uniform price list? It would be a special price to each customer?

A. I could not tell you exactly how that was, only at this time. Doubtless certain orders, there were price lists from which this was developed.

56 Q. Has the Wagner Electric Manufacturing Co. kept a record of these price lists for various years running back to 1896?

A. I think it will develop in correspondence bearing upon these orders, just as it will develop in these orders themselves, just what those lists and prices were.

57 Q. I will ask you this, because we cannot let this question remain up in the air: Is there any data in any of these record books produced here by you before the Master, to enable you to tell the prices of each one of the transformers contemplated by order No. 4048 of June 24, 1896, in the sale to W. B. Cantine?

A. I think I can get the information out of this book.

58 Q. Please do so?

A. I think it will take me, however, probably an hour to do it, as I would want to refer to enough orders to establish a list.

Mr. Bakewell: In order to expedite these tedious examination-, involving going over each sale in this record book, in the way of oral testimony before the examiner counsel for complainant suggests, with the consent of the Master, that if the witness will produce, at a later session to be appointed and fixed by the Master, a complete transcript of all sales of the transformers, hereinbefore inquired about, by the Wagner Electric Manufacturing Co. from June 24, 1896 up to and including July 12, 1904, said list being taken from the record books produced by the witness at this morning's session, or from other records of the Wagner Electric Manufacturing Co., said list or transcript of sales, to give the number of the order, the date of each sale, the name and address of the purchaser, the number of transformers sold in each instance, and the size and type of each transformer sold; the gross amount of each sale in each instance, the amount paid as commissions to the agent, where such commission has been paid, and the net amount received by the Wagner Electric Manufacturing Co. in each instance of sale. Where any particular

sale represents more than one transformer, I want the transcript to show, as nearly as possible, the price of each transformer in each sale.

429 With the understanding that this information will be produced, and such a transcript or record made by the witness and produced at a future session to be appointed by the Master, complainant's counsel is willing to have an adjournment for that purpose; and that the witness withdraw the record books produced at this morning's session, for the purpose of enabling him to prepare a statement containing the data above referred to. I make this statement, however, with the understanding that I do not waive my right to examine the original records at any time, or to ask for their production.

Mr. BRYSON: Without waiving any objections or exceptions heretofore taken to the testimony on this accounting, I desire to state that I am willing to produce such a satement or transcript as that requested by complainant's counsel, for the purpose of shortening this record and economizing time, provided that the first few pages of such transcript shall be inspected and approved as to form by the Master and by complainant's counsel, before the work is completed.

At this point the Master adjourned the further hearing of testimony and proceedings until Wednesday, July 20th, 1904, at 10:00 a. m.

ST. LOUIS, Mo., *July 20th* 1904.

Met pursuant to adjournment as above on Wednesday, July 20th, 1904, at 10 o'clock A. M., present, Special Master H. H. Dennison, Albert C. Fowler, Esq., solicitor for defendant, Mr. Paul Bakewell, solicitor for complainant, and Mr. Waldo A. Layman, the witness, when the following proceedings were had:

A form of tabulation of information as to sales was presented by the stenographer, and after inspection was accepted and agreed upon as the proper form for the entries in the record.

Thereupon an adjournment was had until Wednesday, July 27th, 1904, at 10 o'clock A. M., at the office of Messrs. Bakewell and Cornwall, for the purpose of enabling the stenographer to proceed with the tabulation.

ST. LOUIS, Mo., *July 27th*, 1904.

Met pursuant to adjournment as above on Wednesday, July, 27th, 1904, at 10 o'clock a. m., when by agreement of counsel representing the complainant and the defendant, the Master adjourned the further hearing of testimony in this cause to Wednesday, August 24th, 1904, at 10 o'clock a. m.

430 ST. LOUIS, Mo., *August 24th*, 1904.

Met pursuant to adjournment as above on Wednesday, August 24th, 1904, at 10 o'clock a. m., when by agreement of counsel representing the complainant and the defendant, the Master adjourned the further hearing of testimony in this cause to Wednesday, September 7th, 1904, at 10 o'clock a. m.

ST. LOUIS, MO., WEDNESDAY, *Sept.* 7, 1904.

Met pursuant to adjournment as above on Wednesday, September 7th, 1904, at 10 o'clock a. m.

Present: Paul Bakewell, Esq., counsel for complainant, and A. C. Fowler, Esq., counsel for defendant.

The tabulation of the defendant's books was presented and filed and the further taking of testimony adjourned until 11 a. m. Monday, September 12, 1904.

ST. LOUIS, MO., *September* 12, 1904.

Met pursuant to adjournment as above on Monday, September 12, 1904, at 11 o'clock a. m. Present: Mr. H. H. Denison, Special Master; Mr. Paul Bakewell representing the complainant; Mr. Albert Fowler representing the defendant; and the witness, Mr. W. A. Layman, when the following proceedings were had:

Direct examination of Mr. W. A. LAYMAN continued as follows:

Mr. BAKEWELL:

59 Q. At our last adjourned session, on September 7th, you presented and filed what purports to be a transcript from the books of original entry of the Wagner Electric Company, in respect to the transformers made and sold by the Wagner Electric Company from June 24, 1896; this transcript is in two sections, each of which covers 182 typewritten pages; Do you identify this transcript as the one presented and filed at the last session?

A. I was not present at the last session, but this is the transcript which has been made up under my direction, and which is the matter you want, I think.

60 Q. This is the matter inquired about in my questions to you when you were last on the stand?

A. Yes, sir, your questions on the subject.

61 Q. Before the transcript was made up?

A. Yes sir, before the transcript was made up.

62 Q. Up to what time does this transcript go? What is the last date?

431 A. It goes up to November 14, 1901 (after examining transcript). I thought it was dated but I see it is not. That is the date of my instructions to the representative of the Special Master who is making the investigation. That is up to the date when the Court decided this construction to be an infringement.

[63 —.] Is this transcript accurate, and does it give a list of all the transformers inquired about in my previous questions, which have been made and sold by the Wagner Electric Company since the 24th day of June, 1896, up to and including the date of the expiration of this patent in suit, to-wit: July 12, 1904?

A. To my best knowledge it is. The schedules were made out under my instructions. I have not personally checked them, but my instructions were followed by the representative of the Master and so far as I know the transcript is complete. It is a very laborious proceeding, and I could not make the schedule myself or check over

every item; but the books were placed in the hands of the representative of the Master, and the transcript made, and everything was done under my directions; and to my best knowledge and belief it is all there.

At this point the Master adjourned the further hearing of testimony until Monday, September 26th, 1904 at 10 o'clock a. m.

ST. LOUIS, MO., *Sept. 26, 1904.*

Met pursuant to adjournment as above, on Monday, September 26th, 1904, at 10 o'clock a. m.

Present, Mr. H. H. Denison, Special Master; Mr. D. W. Cooper, representing the complainant, Mr. A. W. Fowler representing the defendant; and the witness, Mr. W. A. Layman; when the following proceedings were had:

Direct examination of Mr. W. A. LAYMAN, continued as follows:

Mr. COOPER:

64 Q. I understand that you accept the transcript from your company's books, consisting of some 182 pages, which have been offered in evidence, as being correct, and as your own statement of the matters covered by it?

A. As explained to Mr. Bakewell in a previous examination, I have not personally compiled this report; but it has been made according to my instructions, and by clerks in whom I have confidence, and to my best knowledge and belief it is correct.

65 Q. Have you, yourself, been over it?

432 A. I have simply glanced through it. I could not check it without an absolute comparison with the records from which it was taken, comprising some twenty volumes of orders.

66 Q. Does it, for example, include some seven transformers sold to the Union Carbide Co., each of which was of large capacity say about 750 Kilowatts?

A. I happen to know that it does not include those transformers, because I was specifically asked by the clerk compiling the record whether those should be incorporated in the transcript, and I said no; because those transformers had eliminated from them the features of claim 4 of this Westinghouse patent.

Complainant's counsel moves to strike out that part of the answer which commences with the words "because those transformers had eliminated from them, etc".

Motion overruled. Counsel for complainant excepts.

67 Q. When were those transformers sold to the Union Carbide Company?

A. I cannot give you the exact date, but they were within the time limits of this record, which I suppose is what you want to know.

68 Q. That is, less than six years previous to the filing of the Bill of Complaint in this suit, the Bill of Complaint having been filed in June 1902?

A. I think so.

69 Q. Don't you know those Union Carbide transformers were sold later than June 1896 and earlier than June 1902?

A. My best recollection and belief now is that they were. I know they occur in the time interval of that record, because of the question asked me when compiling the record.

70 Q. What other transformers that you now recall were omitted for a like or any other reason?

A. I know of no other transformers.

71 Q. Are you willing to swear positively that none other were omitted from the transcript?

A. To my best knowledge and belief no others were omitted.

72 Q. Those transformers sold to the Union Carbide Company infringe the patent when they were sold, did they not?

A. They did not.

Complainant's counsel requests the Master to direct the witness to report upon the transformers sold to the Union Carbide Co., in the same manner that he has reported on the other infringing transformers sold.

The MASTER: The order will be made, as requested.

433 Mr. FOWLER: Should not that report also show the date when these transformers were changed?

The MASTER: The witness has said they were sold during the period, and that at the time they were sold they were an infringement. In my view he should then carry these into this transcript, in the same manner in which the others are carried. If before the transformers were put into use, changes were made eliminating the infringement, that is a matter of defense, and will be admitted, if changed.

73 Q. In order that the report so far made may be more intelligible, I will ask you to explain the following terms which appear on various pages thereof: "Type D;" "Special;" "Motor T;" "Arc Trns;" "Water J;" "G;" "F;" "Spec. F;" "K;" "H;" "L;" "M?"

A. All these terms are factory terms, applying to the number, type of mechanism, or electrical construction.

"Type D" refers to the oil filled transformers, manufactured over a certain period of time, employing certain mechanical features of construction.

"Motor T," refers to a transformer for motor service rather than for incandescent lamp service.

"Arc Transformers" refers to transformers for supplying arc lights rather than incandescent lamps.

"Water J" probably means "Water jacket." The terms "G," "F," "Spec. F", "K," "L," "H," "L," "M" designate different forms of design, as to the particular mechanical characteristics of the winding or of the boxes, or some other features; there being sufficient difference between the various types to make it desirable, for factory reasons chiefly, to change the name of the type.

74 Q. You say that "'Water J'" probably "means Water jacketed;" I will call your attention to order No. 5955, appearing

on page 38-38-*a* of your report, where the term "Water J" is used: And ask if you can identify the term definitely in that connection?

A. I am confident that is the meaning of the term in that case.

75 Q. Constructional differences between "G," "F," "Spec. F," "K," "H," "L" and "M' have nothing to do with the issues in this matter, I presume, so far as you understand them?

A. No, sir, they have not.

76 Q. At what time did you cease to embody the patented improvement, which is the subject of this suit, in transformers?

A. I have already stated that to my best knowledge we dis-
434 continued the use of this construction at the time of Judge Hazel's decision, adverse to the Wagner Co., in the Union Carbide case. I have endeavored to confirm my belief by careful search at the factory, and still feel, so far as my investigation has gone, that the work was discontinued at that time.

77 Q. Do not your factory records show absolutely when the change was made.

A. They do not, because no record was ever kept, at any time in the company's history, of the feature of construction involved in this case. I recall having given instructions at the time of the Court's decision, to discontinue the use of this feature of construction; but have been unable to find any written instruction to this effect.

78 Q. Then when you stopped your report with the sales of November 14, 1901, you did so for the reason that that was the time that the news of Judge Hazel's opinion reached you?

A. Yes, sir.

79 Q. And you have nothing but that fact to fix the date?

A. I have the further fact that the foreman of the winding department dates the discontinuance of the construction with a specific order for transformers, the date of which is November 9, 1901. He states that from the date of that order he had the company's instruction to build no further transformers using this feature.

Counsel for complainant objects to the answer on the ground that it is hearsay.

The MASTER: So far as that is a statement made to the witness by a foreman, the objection to the answer will be sustained, unless the witness means to say he gave orders to the foreman himself.

A. (continued). I gave the order personally.

80 Q. And you rely on the alleged statement of the foreman, that the date when you gave the order was November 9, 1901?

A. I do.

Counsel for complainant renews his objection.

A. (continued). I must have given written instructions, in the shape of a passing memorandum; but I have looked for the original and also for the carbon copy and have been unable to find them.

Objection overruled.

Counsel for complainant excepts.

81 Q. The patented improvement was applied, then, to all
435 the different types of transformers, covered by the individuals named in your report?

A. It was. I suppose by "report" you mean the record here in this case?

82 Q. I mean the 182 pages, or thereabouts of transcript, or copy from your company's books?

A. So far as I know irrespective of type, the transformers in that record embody the construction claimed for the Westinghouse patent.

83 Q. What I want to get at is this: Whether your company, during the time covered by the report, applied the patented improvement generally to all these different types of transformers, which were recognized as different types in this construction department?

A. The company applied the construction in some transformers and not in others. Certain transformers of each type did not employ the construction, while others did. The factory had no detailed instructions at any time as to employing this feature of construction, while it was utilized by the foreman of the department as a mechanical convenience.

84 Q. Does this report of 182 pages, which you have made, cover all the transformers made and sold during the period beginning in June 1896 and ending November 14, 1901, which belonged to the types or classes known in your factory as Type D, Motor T, Water J, G, F, Spec. F, K, H, L and M?

A. To my best knowledge and belief it does.

85 Q. The report, then, covers all of those types which you have sold under your belief and admission that all of the types that were sold had the patented improvement in them?

A. As I stated, the report covers all transformers sold in that time or interval, which utilized or used the Westinghouse patent.

86 Q. And all those types or names sold, you believe had that in them: But what I am getting at is, whether there were any transformers belonging to these types, sold during that time, which did not have the patented improvement?

A. I know positively there were. But all those types which employed the Westinghouse construction have been incorporated in this record.

87 Q. How did you distinguish, in going over your record, those transformers of Type D, for example, which did have the patented improvement in them from those which did not?

A. By the fact that in all small transformers, all trans-
formers smaller than sizes shown in this record, the spacing
436 strips were never used, and never have been since the company has been engaged in the manufacture of transformers.

88 Q. You judge, then, from the size of the transformers?

A. Yes, sir.

89 Q. And without regard to the factory type, or other designation?

A. Yes, sir.

90 Q. Will you please also explain what "50 K.W." or "10 K. W.," or any other number before the letters "K.W." signifies in your report?

A. It indicates 50 Kilowatts in capacity, as the company handled it in transformer work.

91 Q. And what relation, if any, is there between a Kilowatt size and a Light size; for example, on page 1-*a* of the report, order No. 4046 says "20 Light size"; and order No. 4074 gives the "50 K. W." size?

A. In transformer practice 1 Kilowatt is the equivalent of 20 nominal incandescent lights.

92 Q. So according to your factory rating a 20 light transformer would be the same as a 1 Kilowatt transformer?

A. Yes, sir.

93 Q. And the other sizes of your report, when given in lights, would bear the same ratio to Kilowatt?

A. Yes, sir.

94 Q. I would like to call your attention, in this report, to what I think are several possibly inadvertent misstatements. Take for example page 95-*a* and look at order No. 2339: That is stated to be for one 3 Kilowatt transformer of the Type F, sold to the customer at $42. Immediately succeeding is Order No. 2340 purporting to be for 1 20 Kilowatt transformer of the G type, purporting to have been sold for $20?

A. That probably is an error. The 20 Kilowatt should have been "20 Light." The price indicates that the Kilowatt rating is a mistake.

95 Q. If you will look at another page, which caught my eye, No. 29-*a*, you will find with reference to all the orders succeeding No. 4268, that same error has been repeated, apparently?

A. I think you are right.

Mr. Cooper: With the consent of the Master I will ask you to go over the report as filed; with a view of correcting errors of this sort, which seem to have been caused by the use of ditto marks, or other typographical errors.

It is agreed that the errors above referred to may be corrected by the witness.

Mr. Cooper:

96 Q. Have you had the total amount of infringing business covered by this report made out?

A. In dollars and cents?

437 97 Q. Yes.

A. I have not.

98 Q. Have you estimated, approximately or exactly, the actual profit to your company from it?

A. I have not.

99 Q. The gross profit, by that I mean the total price received less the commissions given the agents, from this infringing business, would be the sum of the columns of figures under the heading "Net to Co."?

A. I presume you mean, instead of gross profit, the gross price received by the company.

100 Q. Yes.

A. I would say that the gross price received by the company for the transformers in this schedule, is the total of the columns headed "Net to the Company."

101 Q. That is to say, the sum of those columns of figures headed "Net to Co." would mean all that the company received from the infringing business, covered by your report: Is that correct?

Counsel for defendant objects to the words "From the infringing business." The price shown in these columns is the net price received by the company on these transformers; and it does not appear that that is the net price received from infringement of this patent. The transformer consists of many features, of which the patented feature forms but one part.

Counsel for complainant asks to have the foregoing statement of counsel stricken from the record, on the ground that it is improper.

Counsel for defendant states that the burden is on the complainant to make out a prima facie case of profit or damages due to the patented invention, and not due to the transformer alone.

The MASTER: The witness has stated that this last column of figures is the net price received by the Company for the sale of the transformers. The question of counsel for complainant, using the words "Infringing business" is improper; and until the witness has stated what are the profits with regard to the infringement, or with regard to the total price of the transformers, it seems to me to be improper to assume that the net price which the company received for the transformers is the gross amount due for the infringement. Of course, it is impossible for me to find what the damages are, unless I know, not only what the gross amount, or the net amount received by the company is, but also what the amount of profit is which the company has made by reason of the

438 infringement.

Counsel for complainant excepts to the ruling.

Mr. COOPER:

102 Q. Your report covers, I understand, so far as you know, with the single exception of a sale to the Union Carbide Co., all the business in electrical transformers done by your company and coming within the decree of the Court which adjudged your Company to be in infringement: Is that correct?

A. Yes sir.

103 Q. And the gross receipts of your company from that business done in infringement of the patent, is represented by the sum of the columns of figures headed in your report, "Total price to Customer": Is that correct?

A. The gross sum received by the company for the transformers in which this feature of construction was employed, is the sum of the columns you specify.

104 Q. And the net price received by the company for the sale

of transformers, of the kind held by the Court to infringe the patent, is the sum of the columns headed "Net to Co."?

A. It is.

At this point by consent of counsel recess was taken until 4 o'clock p. m.

ST. LOUIS, *Sept. 26th*, 1904—4 p. m.

After recess the following proceedings were had:

Mr. COOPER:

105 [—]. Have you prepared the additional sheets for your report covering the sale of transformers to the Union Carbide Co.?

A. I have, and I produce them herewith: I notice the sizes of these transformers are not specified. There are seven 1500 K. W. units and two 500 K. W. Otherwise the record seems to be correct.

Originals are filed with the Master.

106 Q. The seven transformers of 1500 K. W. capacity each, you sold for $2,061.33 each?

A. That is the price each.

107 Q. That is the price you sold them at?

A. Yes sir.

108 Q. And the other two transformers sold to the Union Carbide Co. were of 500 K. W. capacity each, you sold for $515.33?

A. Yes sir, that is correct.

109 Q. No commission was paid to any agents on this sale?

A. No, sir, none.

439 110 Q. So that the total price to the customer represented the actual amount received by your Company in payment?

A. Yes, sir.

111 Q. Do your company's books show the cost of manufacturing the transformers which are covered in the report, or transcript, you have filed with the Master?

A. To the best of my knowledge they do not.

112 Q. From whom in your company's employ should I inquire whether they do or do not?

A. This information could only be given by myself, and I cannot make a positive statement without further examination.

113 Q. Are you in a position to ascertain from the books from which this transcript was made, or otherwise, the cost of manufacturing of all the transformers covered by the report?

A. I can only determine by reference to the books of the Company for the period covered by the record.

114 Q. In fixing the selling price of these various sizes of transformers covered by your report, did not your Company first ascertain for itself the cost of manufacturing them?

A. It is usual to approximate the cost of manufacture in advance.

115 Q. That was done, as a matter of fact, with respect to the transformers covered by this report, was it not?

A. I presume it was, although I can only determine by further investigation.

116 Q. Do you not know, as a matter of fact, that your Company

has on hand, and has had on hand, from year to year, figures which show the cost of manufacturing all these various sizes and types of transformers?

A. Such figures have been made from year to year, but whether they are on hand I can only tell by further investigation.

117 Q. And those figures are accepted as correct for the purpose of your company's business, are they not?

A. They are not accepted as cost price, but are used for fixing the selling price, together with the competitive prices of other manufacturers.

The MASTER: Is there any relation between the cost price of production and the selling price, as a fixed point?

A. There is no such fixed relation.

Mr. COOPER:

118 Q. Has not your Company verified from time to time the cost price which you have described as having been in a sense fixed in advance?

440 A. That is true in specific instances, but I am not prepared to state that it is true as a general proposition over the period of this record, for the reason that the Wagner Company had no well organized cost department over practically the entire period covered by this record.

119 Q. But it has such a cost department?

A. We have such a cost department at the present time.

120 Q. And the figures and cost of each you now estimate are made up from the present prices of material and from your present methods of construction, are they not?

A. We generally estimate the costs in advance on all products and at a later period determine whether such costs were correct or not.

121 Q. That is just what I am getting at. Has your Company not now figured out the actual cost of these various types of transformers to a point where their cost of manufacture may be considered to be fixed and definite?

A. The cost of manufacturing varies through wide limits and a cost which would be fixed for any considerable period of time cannot be established.

122 Q. The variations are due to variations of cost in material, are they not, wages, labor and improvements in the process of manufacture?

A. They involve the three items you mention and also the total volume of business done.

122 Q. The greater the volume of business done, generally speaking, the less the cost of manufacture?

A. That is true to some extent. If a small volume of business be done the cost of manufacturing might be three or four times the actual selling price of the apparatus.

123 Q. The process of manufacturing these devices have, of course, advanced gradually to a better plane, have they not?

A. I think there has been some improvement.

124 Q. So that that element would tend to diminish the cost of manufacture from year to year rather than to increase it?

A. If improvements of any importance arose the costs might be decreased as compared with the same items at a different period.

125 Q. That is the actual fact in that regard?

A. I do not think there has been any material change in the methods of construction for several years.

126 Q. So that that element may be eliminated from the variations in the cost of production?

A. I think so.

127 Q. So far as the volume of business is concerned that has increased, has it not, say the last six years?

A. Referring to the previous question again: I might say the factor you speak of may be eliminated with respect to a particular transformer, but I cannot say it can be eliminated as a whole. The factory costs are of a complex character and always difficult to arrive at.

441

Q. (Previous question read).

A. I cannot say off-hand about the volume of business.

128 [—]. Can you prepare from the company's books figures which will show such approximated estimate as may be accepted for the purpose of this accounting, the cost of production of the transformers covered by the report heretofore made?

A. As stated above, I cannot positively say until I have investigated, and have determined just what records are available on this score.

129 Q. If the proper records are available will you prepare such a statement?

A. Under the direction of the Master.

Complainant's counsel requests the Master to instruct the witness to prepare and present at the next hearing, a transcript or summary, or report from the books of the defendant Company, which shall show separately the cost of material and the cost of labor entering into each of the transformers covered by the report herewith filed, and separately any other element of cost which shall enter into the cost of production thereof.

The request of Counsel is sustained and the Master so orders.

Upon agreement of counsel the hearing is adjourned until the 17th day of October, at the same hour and place, subject, however, to be called at an earlier day if the witness shall before that time succeed in compiling the necessary compilation. In that case notice will be given to all parties of an earlier hearing.

ST. LOUIS, MO., *October* 17, 1904.

Met pursuant to adjournment as above on Monday, October 17, 1904, at 10 o'clock a. m., at the same place; present, the Hon. H. H. Denison, Special Master, Mr. Paul Bakewell, Counsel for the Complainant; and Mr. A. C. Fowler, Counsel for Defendant.

Direct examination of the witness, W. A. LAYMAN, continued as follows by Mr. Bakewell:

130 Q. Mr. Layman at the last session, at the request of Complainant's counsel, you were ordered to prepare and present at the next hearing a transcript, or summary, or report, from the books of the Defendant Company, which would show separately the cost of material and the cost of labor entering into each of the transformers covered by the report heretofore filed; and separately in every
442 element of cost which would enter into the cost of production thereof: Have you such a report this morning?

A. I have not been able to prepare such report, because the books of Company do not give the information asked for. As stated at a previous examination I have been unable to find any cost records extending over the period of this examination from which such report as requested can be made up. The best I am able to submit is a statement of total sales of all kinds of apparatus, and total profits for the corresponding period.

131 Q. Total sales of what kind of apparatus?

A. All kinds of apparatus made by the Company. The total volume of business of the Company and the total volume of profits of the Company.

132 [—]. And you are not able to give the data from which we can ascertain the cost of manufacture of the transformers?

A. I am not.

133 Q. And the profits made on the transformers?

A. I am not able to give that information.

134 Q. You wish to be understood as stating that you have carefully examined the books of the Company, and that the information called for at the last session cannot be ascertained from the books of the Defendant corporation?

A. Yes, sir.

135 Q. Without waiving the right of Complainant to inquire more particularly as to the facts and data concerning the actual cost of manufacture of the transformers hereinbefore inquired about, and of the profits made by the Defendant corporation on such transformers, I now ask you to give us the information which you say you have for what it may be worth?

A. If the Secretary will put this down in tabular form as I give it, it will comprise the information you asked for:

Year.	Total volume Company's business.	Proportion of business involved in the record of this inquiry.	Total profits of the Company on all kinds of apparatus.	
1896	$238,122.35	$ 65,601.82	Profit	$20,707.33
1897	226,096.46	128,244.12	Loss	21,743.38
1898	343,494.76	148,542.29	Profit	62,592.12
1899	411,337.74	235,335.78	"	58,382.67
1900	515,013.32	230,732.67	Loss	12,277.57
1901	580,710.10	146,815.08	Profit	40,318.90
	$2,314,774.73	$955,271.76		

At this point, by consent of counsel, the further hearing of this case was adjourned to Monday, November 7th, 1904.

443 ST. LOUIS, Mo., *Nov.* 7, 1904.

Met pursuant to adjournment as above on Monday, November 7, 1904, at 10 o'clock a. m., at the same place; Present, Hon. H. H. Denison, Special Master; Mr. Paul Bakewell, Counsel for the Complainant.

With consent of counsel the Special Master adjourned the further hearing of testimony to Wednesday, November 9, 1904, at 10 o'clock a. m.

ST. LOUIS, Mo., *November* 9, 1904.

Met pursuant to adjournment as above on Wednesday, November 9, 1904, at 11 o'clock a. m.; Present, Hon. H. H. Denison, Special Master; Mr. Paul Bakewell, Solicitor for Complainant; Mr. Albert H. Fowler, Solicitor for Defendant and the witness W. A. Layman, when the following proceedings were had:

Counsel for complainant states that the Direct Examination of the witness W. A. Layman is here closed.

Counsel for Defendant states there will be no cross examination.

Counsel for Plaintiff announces that in the matter of this accounting this plaintiff will also rely on the record of the case of the Westinghouse Electric & Mfg. Co. vs. the Wagner Electric Mfg. Co., in the United States Circuit Court for the Eastern Division of the Eastern District of Missouri, Equity No. 4457, including the exhibits introduced in said case; which case is the present case in which this accounting is taking place.

Also the record in the case of the Westinghouse Electric & Mfg. Co. vs. Union Carbide Co., which was put in evidence by the Defendant in this case and is marked "Defendant's Exhibit 1, Union Carbide Record."

It is understood and agreed between counsel that the Opinion of the United States Court of Appeals in the said case of the Westinghouse Electric & Mfg. Co. vs. Union Carbide Co., as it appears in the Federal Reporter 117, between pages 495 and 501, may be used with the same force and effect as if it had been formally introduced in evidence, and a certified copy thereof produced and filed as an exhibit.

At this point the further hearing of testimony was by consent, adjourned to Wednesday, November 16, 1904, at 10 o'clock a. m.

444 ST. LOUIS, *November* 16, 1904.

Met pursuant to adjournment as above on Wednesday, November 16, 1904, at 10 o'clock a. m., at the same place.

Present, Hon. H. H. Denison, Special Master; Mr. Paul Bakewell, Solicitor for Complainant, and Mr. Albert H. Fowler, Solicitor for Defendant.

With consent of counsel the Special Master adjourned the further hearing of testimony to Wednesday, November 23, 1904, at 10 o'clock a. m.

ST. LOUIS, *November* 23, 1904.

Met pursuant to adjournment as above on Wednesday, November 23, 1904, at 10 o'clock a. m., at the same place.

Present, Hon. H. H. Denison, Special Master; Mr. Paul Bakewell, Solicitor for Complainant, and Mr. Albert H. Fowler, Solicitor for Defendant.

With consent of counsel the Special Master adjourned the further hearing of testimony to Monday, December 5, 1904, at 10 o'clock a. m.

ST. LOUIS, MONDAY, *December* 5, 1904.

Met pursuant to adjournment as above on Monday, December 5, 1904, at 10 o'clock a. m., at the same place.

Present, Hon. H. H. Denison, Special Master; Mr. Paul Bakewel Solicitor for Complainant, and Mr. Albert H. Fowler, Solicitor for Defendant.

With consent of counsel the Special Master adjourned the further hearing of testimony to December 19, 1904, at 10 o'clock.

ST. LOUIS, *December* 19, 1904.

Met pursuant to adjournment as above on Monday, December 19, 1904, at 10 o'clock a. m., at the same place.

Present, Hon. H. H. Denison, Special Master; Mr. Paul Bakewell Solicitor for Complainant, and Mr. Albert H. Fowler, Solicitor for Defendant.

With consent of counsel the Special Master adjourned the further hearing of testimony to Tuesday, January 3, 1905, at 10 o'clock a. m.

ST. LOUIS, *January* 3, 1905.

Met pursuant to adjournment as above on Tuesday, January 3, 1905, at 10 o'clock a. m., at the same place.

445 Present, Hon. H. H. Denison, Special Master; Mr. Paul Bakewell, Solicitor for Complainant, and Mr. Albert H. Fowler, Solicitor for Defendant.

With consent of counsel the Special Master adjourned the further hearing of testimony to Monday, January 16, 1905, at 10 o'clock a. m.

ST. LOUIS, *January* 16, 1905.

Met pursuant to adjournment as above on Monday, January 16, 1905, at 10 o'clock a. m., at the same place.

Present, Hon. H. H. Denison, Special Master; Mr. Paul Bakewell Solicitor for Complainant, and Mr. Albert H. Fowler, Solicitor for Defendant.

With consent of counsel the Special Master adjourned the further hearing of testimony to Wednesday, January 25, 1905, at 10 o'clock a. m.

ST. LOUIS, *January* 25, 1905.

Met pursuant to adjournment as above on Wednesday, January 25, 1905, at 10 o'clock a. m., at the same place.

Present, Hon. H. H. Denison, Special Master; Mr. Paul Bakewell,

Solicitor for Complainant, and Mr. Albert H. Fowler, Solicitor for Defendant.

In the presence of and with consent of counsel for complainant and defendant, it is ordered that the hearing be now adjourned to February 9th, 1905, at the office of the Westinghouse Electric & Manufacturing Company, in the Westinghouse Building, Corner Ninth and Pennsylvania Avenue, in the city of Pittsburg, State of Pennsylvania, when and where the hearing of the matters referred will be resumed and continued from day to day, until otherwise ordered, at which time and place, and at such other times and places as may be then ordered, all parties are ordered and required to attend.

In the United States Circuit Court, Eastern Division of the Eastern Judicial District of Missouri.

No. 4457. In Equity.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY
vs.
WAGNER ELECTRIC MANUFACTURING COMPANY.

Testimony on Accounting.

Testimony on behalf of Complainant taken at the office of the Westinghouse Electric & Manufacturing Company, Westinghouse Building, Pittsburg, Pennsylvania, beginning at 2:00 o'clock p. m., on February the 9th, 1905, before Henry H. Denison, Esq., Special Master appointed by this Court under its Interlocutory Decree in this cause, dated the 16th day of February, 1904.

446

Present:

Paul Bakewell, Esq., Solicitor for Complainant.
Albert C. Fowler, Esq., Solicitor for Defendant.

SVEND E. JOHANNESEN, a witness produced on behalf of Complainant, being first duly sworn, testifies as follows:

By Mr. BAKEWELL:

Q. 1. What is your name, age, residence and occupation?

A. S. E. Johannesen. My age is thirty-nine years. I am employed as electrical engineer by the Westinghouse Electric & Manufacturing Company. My residence is Edgewood Park, Pennsylvania.

Q. 2. Do you know the Wagner Electric Manufacturing Company, the defendant in this case?

A. Yes sir.

Q. 3. Were you ever in the employment of the Wagner Electric Manufacturing Company, the defendant in this case, and if so, during what period of time

A. Yes sir. I entered the employ of the Wagner Electric Manufacturing Company in the early part of July, 1893. From that time until the latter part of 1895, I was employed in the Transformer Testing Department. From December, 1895, until I resigned my position with that Company, I was engineer of the Transformer Department.

Q. 4. When did you resign your position with the Wagner Electric Manufacturing Company?

A. In the latter part of September, 1902.

Q. 5. Do you know Waldo A. Layman of the Wagner Electric Manufacturing Company, the defendant in this suit—the defendant corporation in this case?

A. Yes sir.

Q. 6. How long have you known Mr. Layman?

A. I have known him since the early part of 1890.

Q. 7. Have you read the transcript of the testimony of Waldo A. Layman given in this case before the Master, a duplicate transcript of which testimony is now before us?

A. Yes sir, I have examined it.

Q. 8. Under the decree in this case, under and by virtue of which we are taking testimony before Mr. Denison, the Master, it was found by the Court that the defendant in this case, the Wagner Electric Manufacturing Company, had infringed claim 4 of the Westinghouse patent in suit, being United States Letters Patent for Electrical Converter, or Transformer, No. 366,362, dated July 12, 1887, claim 4 of that patent being in the following words:

447 The combination, substantially as described, of an electric converter constructed with open spaces in its core, an enclosing case, and a non-conducting fluid or gas in said case adapted to circulate through said spaces and about the converter.

In taking the testimony before the Master on this accounting, we have before us, furnished by Mr. Layman, what purports to be transcripts from the books of the Wagner Electric Manufacturing Company of transformers embodying in their construction the invention of the said fourth claim of the said Westinghouse patent, No. 366,362, this typewritten transcript being in two sections, as the typewritten pages are not large enough to contain all of the data on one page, each of these sections covering one hundred and eighty-three typewritten pages. This transcript is supposed to contain a record of transformers made and sold by the Wagner Electric Manufacturing Company embodying the invention the subject-matter of claim 4 of the said Westinghouse patent, covering a period from June 24, 1896, up to and including, as I recall Mr. Layman's testimony, the date of November 19th, 1901. I now ask you whether you were in the employment of the defendant corporation, the Wagner Electric Manufacturing Company, during the time covered by this transcript or list of transformers furnished by Mr. Layman, and which covers, as I have said, the period of from June 24th, 1896, up to and including November 19th, 1901.

A. Yes sir, I was in the employ of the Wagner Company during that period.

Q. 9. What were your duties with the Wagner Company during that period last referred to?

A. I was engineer in charge of the Transformer Department and was intimately associated with the design and manufacture and the testing of the transformers made by that Company.

Q. 10. During that period of time, did your duties enable or require you to ascertain the cost to the Wagner Company, (I shall refer in my questions to the Wagner Company for the sake of brevity), of transformers made and sold by the Wagner Company?

A. Yes sir; during the period that I was engineer of the Company it was my duty to also get up the prices or the cost of the transformers. These costs were very carefully made up in every detail. Every item connected with the manufacture and with the material contained in the transformers was included in these costs.

Q. 11. In what shape was this data gotten up by you for the Wagner Company, the defendant in this case, and inform
448 us, as nearly as you can, how specific such items of cost were in respect to details entering into the construction of the transformers.

A. Under the subject of Labor, every operation was itemized under a separate heading. For instance, various operations of the transformer are the winding of the coils, the cutting and annealing of the iron, the process of insulation, the mounting of the transformer—which is the same as building on of the iron, the boxing of the transformer, the packing of the transformer and so on. Under material, every item was similarly considered, such, for instance, as the copper contained in the coils, the iron contained in the core, the case, the various forms of insulation used, the terminal cables and so on.

Q. 12. In other words, as I understand it, the data which you prepared for the Wagner Company would cover every detail of labor utilized in the manufacture of the transformer, including even the boxing for shipment; and, in respect to material, the data which you would prepare for the Wagner Company would include the cost of every element of material which entered into the construction of the transformer up to and including the shipment of the same. Am I correct in this?

A. Yes, sir. Especially in the standard line of transformers, the detail of cost was done with very great care. In the larger size of transformer, the details were not so marked, although for these transformers also itemized costs were gotten out.

Q. 13. In what form was this data gotten up by you for the Wagner Company—as to cost of labor and material entering into the construction of these transformers?

A. It was gotten out in tabulated form, and, as a general rule, the copies which were sent to the person in charge of the sales, it was in manuscript form. In special instances, however, they were gotten out in the form of tracings, from which it was possible to make prints or duplicates of the same.

Q. 14. On tracing linen so that blue-prints could be made of the same?

A. Yes sir, in some instances.

Q. 15. Do you know whether or not this tabulated, itemized state-

ment of cost of labor and material entering into the manufacture of these transformers was kept by the Wagner Company as a record. I mean, of course, during the period of time that you were there.

A. In the case of the manuscript copies which were sent to the office, I do not know; but in cases where there were tracings made, they should have been, of course, kept. In some instances, where the record was kept in the engineering office, I know that
449 there were records of costs when I left the Wagner Company, because they were contained in books which were handled by me. These costs, however, do not include the cost of everything for every transformer made during the period that I was with the Wagner Company, but they cover some of the cost. I mean to say that it oftentime happened that the costs were sent to the man who was in charge of the sales, or the superintendent, and those were gotten out probably in certain forms and all the data was sent down stairs; but there were instances where these records were kept in my own books in the engineering office.

Q. 16. What do you mean by saying in your last answer, "sent down stairs?"

A. The engineering office of the Wagner Electric Manufacturing Company, during the last three years of my connection with that Company, was on the last floor of their building. The man in charge of sales, or the superintendent's offices, were on the first floor of the same building.

Q. 17. Have you examined this account or list of transformers furnished to the Master in this case by Mr. Layman, this transcript being before me now on the table and being in two sections, each section covering, as I have said, one hundred and eighty-three typewritten pages, and supposed to contain a list of transformers embodying the invention of claim 4 of the Westinghouse patent in suit which were made and sold by the Wagner Company, the defendant in this case, between June 24th, 1896, and November 19th, 1901?

A. Yes sir, I have examined it.

Q. 18. From the practice which prevailed at the place of business of the Wagner Company, the defendant in this case, what have you to say as to whether or not a record was made of the cost of manufacture of the transformers covered by that tabulated statement.

A. I do not believe I fully understand your question.

Q. 19. I understood you to state that during that period of time covered by this transcript or record of transformers made and sold by the Wagner Company, the defendant in this case, it was the practice of the Company to get up a record of the cost of labor and material entering into the construction of the transformers made by the Wagner Electric Company, the defendant in this case. Did I understand you correctly?

A. Yes sir.

Q. 20. That being so, what have you to say as to whether or not that course of practice was applied to all transformers made by the Wagner Company from June 24, 1896, until November 19th, 1901, which, of course, would include the transformers specified in this transcript? Do you understand my question?

450 A. Yes sir. A table of cost was made in the engineering office and was sent to the office of the Wagner Company. From those costs, the Wagner Company made up their lists, by which the transformers were sold. As to whether or not they kept records of these in the office, I do not know.

Q. 21. As I understand the testimony that you have already given, it was the practice of the Wagner Company during the period of time covered by this tabulated statement or list of transformers, to which I have repeatedly referred, that is to say, from June 24th, 1896, up to and including November 19th, 1901, to obtain from the engineer's office, or your office, an itemized, tabulated statement as to every element of cost in labor and material that entered into the construction and manufacture of the transformers made and sold by the Wagner Electric Company. Have I understood you correctly in that respect?

A. In the case of the itemized, tabulated form of various operations, these were kept in the engineering office, but their totals were sent to the man in charge of sales, or the superintendent.

Q. 22. In addition to this record showing, as I presume it might be proper to call it, the flat cost of labor and material entering into the construction of these transformers, what practice, if any, prevailed at the plant of the Wagner Company, the defendant in this case, during the time covered by this record or transcript of transformers; that is to say, from June 24th, 1896, up to and including November 19th, 1901, in regard to charging anything else against each transformer made by the Wagner Company in the way of cost?

A. The factory cost of the transformer is made up of two elements, the first being the flat labor and material values and including the actual cost of labor and material involved in the transformer. Second, the expense value, which included the salaries of officers, of engineers and of other employés not included in the flat values, and all other expenses connected with the manufacture of the transformers.

Q. 23. Was that done at the Wagner Company's place of business during the time referred to in my last question; that is to say, from June 24th, 1896, up to and including November 19th, 1901, and if so, what was the practice in this respect of the Wagner Company during the time mentioned as to charging against transformers a certain sum for factory cost over and above what I have designated as the flat cost of labor and material?

A. The expense percentage during the time in question ranged approximately between 25 per cent. and 40 per cent. During the last year or two of the time in question, the expense per cent. was forty.

451 Q. 24. In other words, as I understand you, in estimating the cost to the Wagner Company of making transformers during the period which I have repeatedly referred to, and mentioned in my last question, the transformer was charged with the flat cost of labor and material entering into it plus 25 per cent. or 40 per cent., the 40 per cent. rule applying, as I understand your

testimony, chiefly during the last two years preceding November 19th, 1901. Am I correct in this.

A. Yes sir.

Q. 25. In other words, for the sake simply of illustration, if the flat cost of labor and material entering into a particular transformer was, we will say, $10.00, what would be added to that for the factory cost, so called on the 25 per cent. basis, we will say, and what would be added to it on the 40 per cent. basis,—simply to have a plain illustration on the record.

A. On the 25 per cent. basis $2.50 would be added, making a total of $12.50 as the factory cost.

Q. 26. Including factory cost?

A. I mean as the factory cost; and on the basis of 40 per cent., $4.00 would be added, making $14.00 as the factory cost.

Q. 27. As I understand it, the flat cost of labor and material in the case mentioned in my last question would have been $10.00 and the additional $2.50 in the one case and $4.00 in the other was what you designate as factory cost on the 25 or 40 per cent. basis.

A. The 25 and 40 per cent. are expense values, and when they are added to the flat labor and material values, they give what is known as the factory cost.

Q. 28. Yes. State again, if you please, if you have not already stated it, what this 25 or 40 per cent. added to the flat labor and material cost was supposed to represent under the practice prevailing with the Wagner Company during that period of time which I have inquired about, that is, from June 24, 1896, up to and including November 19th, 1901.

A. It represents the running expenses of the Company in connection with the transformers in question and was supposed to include everything which was not already counted in the flat labor and material values.

Q. 29. What have you to say, in view of the practice which you have referred to prevailing at the Wagner Company's place of business during the time referred to in my last question, as to whether or not, while you were with the Wagner Company, and during the period referred to, it was possible to ascertain from the records of the Wagner Company the cost of transformers made by that Company, which cost included, as you have stated, the flat cost
452 of labor and material plus a certain percentage added thereto, to cover generally the expenses of the business or that proportion of the expenses of the business chargeable to the transformers?

A. It should be possible to ascertain these costs. If the original tabulated sheets had been destroyed, they could arrive at the cost of practically every transformer which appears on the transcript referred to by referring to the inventories of the years included in the same.

Q. 30. What do you mean in your last answer by "inventories" and what was the practice of the Wagner Company during the time referred to and covered by this statement; that is to say, from June 24th, 1896, up to and including November 19th, 1901, in

respect to these inventories,—so far as the Wagner Company is concerned.

A. During the time that I was connected with the Wagner Company it was customary to make a record of the manufactured stock and the apparatus contained in the manufactory for the purpose of arriving at the condition or the amount of business done during six months, and these records were taken the 1st. of January and the 1st. of July every year. The Wagner Company always had a stock of transformers on hand which more or less covered the full line of apparatus manufactured by them; and in working up these inventories it was necessary to price the transformers at their factory costs.

Q. 31. Were these inventories kept during the period of time covered by my preceding questions, I mean to say from June 24th, 1896, up to and including November 19th, 1901? By the Wagner Company I mean?

A. As to that I cannot say, but it would seem more than likely that they were kept with the records of the Company, as they are the property of the Company and as a general rule such records are not destroyed.

Q. 32. Would these inventories show the cost of the transformers (assuming, of course, that they have been kept), made and sold by the Wagner Company during the period of time which I have referred to; that is to say, from June 24th, 1896, up to and including November 19th, 1901, and by cost I mean the cost of making these transformers, including flat labor and material plus the percentage added thereto to cover the other expenses of the business chargeable to the transformers?

A. The part of the inventory which I had to do with gave the factory cost of the transformers.

Q. 33. And by factory cost you mean the flat labor and material plus that percentage?

A. Yes sir.

Q. 34. Going back to the question of that percentage added to cover all other incidental expenses chargeable to the trans-
453 formers over and above the flat cost of labor and material, do you mean to be understood as stating that during the period referred to it was the practice of the Wagner Company to add 25 or 40 per cent. or add a percentage ranging from 25 to 40 per cent.?

A. I mean a percentage which ranged at approximately between 25 and 40 per cent.

Q. 35. During the time covered by this transcript or report; that is to say, from June 24, 1896, up to and including November 19, 1901, what practice prevailed at the Wagner Company in respect to the selling price of these transformers? In other words, when it came to the selling price, was it the practice of the Wagner Company to add anything over and above the flat labor and material cost and that percentage which you have referred to ranging from 25 to 40 per cent.?

A. During the time I was with the Company, a rule prevailed,

which was to add a percentage of 25 to the factory cost, and this rule was always used as a base for ascertaining the selling price.

Q. 36. In other words, by the "factory cost," referred to in your last answer, as I understand it, the practice which you say prevailed with the Wagner Company was to take the flat cost of labor and material and add thereto a certain percentage ranging from 25 to 40 per cent., the sum of which items represented the total factory cost, and that to that sum 25 per cent. was added to make the selling price. Am I correct in that?

A. Yes sir. That rule was used as a base for the selling price.

Q. 37. Referring now, generally, to the transcript or record of transformers furnished to us by Mr. Layman, which contains, under different headings, the number of the order, the name of the customer, the residence of customer, date of sale, number of order, number of transformers sold, size, kind, price to customer, total price to customer, commission to agent, net to company, do you find anything lacking in that data which might be desirable or necessary, assuming all of the records of the Wagner Company to have been preserved, to enable you to identify any particular transformer mentioned in that list from the records of the Wagner Company and ascertain the cost of such transformer to the Wagner Company, and if so, what data is lacking?

A. Two very important identifications are missing.

Q. 38. What are they?

A. These are the voltage and the frequency of the transformers.

By the MASTER: The what?

A. The voltage and the frequency.

454 By Mr. BAKEWELL:

Q. 39. Please explain what you mean by voltage and frequency and why that data is important as an identity test, assuming that the records of the Wagner Company have been preserved, to get at the cost in each instance to the Wagner Company of any particular transformer.

A. By voltage is meant the pressure, and by frequency is meant alternation or the rate of alternations per minute of the circuit which the transformer is operating on. It is possible to have two transformers of the same capacity or size and of the same voltage which will be very different in price on account of the frequency of the circuit which they are operating on. As an instance, a transformer designed for 1,000 volts and for a 60 cycle circuit will cost approximately 66 per cent. of a transformer of the same capacity and voltage designed for a circuit of 25 cycles. Also, we may have two transformers of the same capacity and designed for circuits of the same frequency, but they may have different voltages. As an instance, a 1 k. w., 10,000 volt, 60 cycle transformer will cost approximately 40 per cent. more than a transformer designed for 1,000 volts of the same size and frequency.

By Mr. FOWLER:

Q. 40. 10,000 volts compared with one?

A. Yes sir, 10,000 volts with 1,000. They cost more money.

By Mr. BAKEWELL:

Q. 41. If the voltage and frequency were given in this tabulated statement of transformers made and sold by the defendant between June 24th, 1896, and November 19th, 1901, with the other data given in this tabulated statement, and assuming the records of the Wagner Company to have been preserved, what have you to say as to whether or not you would be able to determine, if you had access to the complete records of the Wagner Company, the cost to that Company of the transformers given in this list?

A. It would be quite possible to get at the correct factory cost to within a very small per cent.

Q. 42. What do you mean by a very small per cent.?

A. Well, to within approximately 2 per cent.

Q. 43. When you were with the Wagner Company, especially during that period of time covered by this report or tabulated statement of transformers, from June 24th, 1896, up to and including November 19th, 1901, did the Wagner Company have records, in respect to its transformers which it had made, which records, in addition to the data furnished by this tabulated statement, also gave the voltage and frequency?

455

A. Yes sir.

Q. 44. What records were those?

A. That record would appear on the original stock order, or general order, as they call it, of the Wagner Company. The record of the transformers will also be found in the testing record, as a careful record was kept of the tests of each transformer built by that Company.

Q. 45. What is this which I now hand you? Do you recognize it?

A. It is a catalogue of the Wagner Electric Manufacturing Company giving information on transformers built during the year 1897.

Q. 46. On a page which is opposite to page 26 of this catalogue, which page is, evidently by mistake, numbered 25, please state whether or not you find there what purports to be a price list of Type D transformers made by the Wagner Company, the defendant in this case.

A. On the page referred to there is a price list of a full standard line of transformers, including ½ k.w. to 50 k.w. sizes.

The catalogue referred to is offered in evidence and it is asked that it be marked by the Master Complainant's Exhibit, Wagner Company 1897 Catalogue, with particular reference to the page marked 25 opposite page 26 referred to in the last preceding question to the witness.

Q. 47. By referring to this tabulated statement of transformers, to which I have repeatedly referred and which has been furnished by Mr. Layman, and which as I have said is in two parts, because the ordinary typewriter sheet is not large enough to cover the items as to each transformer, I find, on the duplicate copy which I present to you, at page 182*a* (which does not include the Union Carbide transformers tabulated on the next following page, which page is

not numbered but which should be 183*a*), someone has calculated in pencil the sum of the various amounts on 182 pages of this transcript, under the heading, "Total Price to Customer," and that computation, which is in lead pencil on the duplicate transcript of this record, amounts to $938,092.66. Assuming that the addition is correct, which is a mere matter of computation which is easily susceptible of corroboration or correction, it would appear that, excluding the Union Carbide transformers, the total price to customers for transformers made and sold by the defendant during the period covered by this statement amounts to $938,092.66. On the same page; that is to say, on page 182*a*, (which also excludes the Union
456 Carbide transformers), it has been computed in pencil that the sum of the net amount received by the defendant corporation for these transformers covered by this accounting and covered by claim 4 of the Westinghouse patent in suit amounts to $856,-881.05, which is an amount arrived at after deducting commissions to agents. Also upon the basis that the additions referred to are correct of the various columns covering this record or statement, the difference between $856,881.05, the net amount received by the Company, and the sum of the total price to customers, which is $938,-092.66, is a difference of $81,211.61, which represents, according to that statement, the addition referred to being correct, the amount of commissions paid to agents,—on these assumptions, and I would like you to take a pencil and paper to verify my statements, assuming that the gross price to the customers for these transformers was the total factory cost, which you have already clearly explained, plus 25 per cent. added in each case as the selling price, the total cost of these transformers would be represented by the sum of $750,-474.13, which sum is arrived at in the following manner: by deducting one-fifth from $938,092.66 (which is the gross price to customers, including commissions to agents), then by deducting $750,474.13 from the net price, (the net price being the sum already referred to of $856,881.05),—on the assumptions which I have stated, based on the calculation, the additions being correct, what do you find the net profit to be?

Counsel for the defendant objects to the question as not competent, it not appearing that 25 per cent. in addition to the factory cost was received in each case for the transformers, and further objects to the question as not competent on the ground that the inquiry concerns only the question of profit due to the patented invention as covered by claim 4, which covers an oil-cooled transformer with open spaces in its core and does not cover transformers having open spaces between the coils and between the coils and core, which the transformers now inquired about have. In other words, defendant's counsel objects to this question as attempting to arrive at the total profit due to these transformers in their entirety and not due to the improvement as covered by claim 4.

By Mr. BAKEWELL:

I respectfully submit that, in the first place, nothing could be clearer than the testimony in this record which has been taken be-

fore your Honor and under which the defendants have been called upon to give us a list of the transformers made and sold by them during the time contemplated, which transformers are the
457 transformers the Court has declared infringe this patent. We have a distinct admission on the record, made by Mr. Layman, that each transformer is a transformer which cores within claim 4 of this patent and which the Court has declared to infringe this patent. Now, in regard to the other objection, I wish to say this: Your Honor has heard the testimony of Mr. Layman. It is only necessary to refer to the testimony, which is here, to prove that that officer of the defendant Company tells you himself—the only man who could possibly give the data in regard to the profits made—he tells Your Honor he has no data by which it is possible for him to ascertain the cost of making the transformers. That is the positive statement of Mr. Layman and it is here on the record. It is only necessary to refer to the record to verify my statements. He tells Your Honor that he cannot give you the cost of making these infringing transformers. He also tells Your Honor that he cannot tell Your Honor what profits they have made on that thing. And now we are driven, because we are concerned here in this inquiry with ascertaining the profits they did make,—we are driven to ascertain from the best evidence of which the nature of the case is susceptible, in view of the statement under oath of Mr. Layman—to come here and get testimony of witnesses who were with the Wagner Company to show that Mr. Layman was mistaken. We are not through with our case and I respectfully submit that we are entitled to this inquiry. Mr. Layman does state, on page 164 of his testimony, the proportion of business involved in this record, the total volume of the Company's business during those years; and a certain list of profits made during those years and a certain list of losses made during those years, and when you take the losses from the profits,—he only gives it in a general way—Your Honor will find that that amounts to $182,001.02. Now, may it please Your Honor, the invention here in question is not what my friend has undertaken to state it to be, it is not a part of claim 4, it is the entirety of claim 4, as a Supreme Court of the United States has decided repeatedly, a claim for a combination as an entirety. The Court has found in this case, by its decree that the defendant has copied our invention; that is to say, has infringed our claim and taken that in its entirety. We are not here with one element, but with a combination making an entirety, and in improved transformers,—that transformer which the Court of Appeals in the Carbide case held to be a most valuable invention. Now, may it please Your Honor, I am simply trying to aid in this matter, trying to give one computation. I have taken up my friend's objection and I respectfully submit that
458 it is not well taken, and for the information that your Honor may desire to have in this inquiry, the question that I am putting to the witness is competent, proper, relevant and material. I ask for a ruling.

Defendant's counsel states that he has never contended that the invention in controversy is only a part of claim 4. He admits that it covers the combination of claim 4, or the claim in its entirety, and

in answer to the Complainant's counsel, the Defendant's counsel calls the Master's attention to the decree of this Court and to the latter part of that decree excepting from this injunction certain transformers having, as stated in the decree, open spaces between the coils and between the coils and the core for the circulatiton of oil.

By Mr. BAKEWELL:

I wish to say that that was all up, Your Honor, at the beginning of Mr. Layman's testimony. This statement that is before Your Honor, as the record shows, is a tabulated statement given by Layman, after he was under oath, giving a complete record of the transformers which the Court has specifically found to come within the claim of this patent.

Defendant's counsel states that these transformers also have the features referred to in the paragraph before the last of the decree in this case; to-wit, open spaces between the coils and between the coils and the core.

By the MASTER:

The objection of counsel for the defendant is not well taken, in my opinion, because it assumes that which is not at present before the Master, that this list covers transformers which are not involved in this controversy. It may be that hereafter the question may arise as to whether the 4th claim can be distinguished from the entirety of the transformers and whether the damages resulting from the infringement of the 4th claim will necessarily be the net profit on transformers in an entirety, but that does not arise in this question here. The question before the Master now is simply one of computation by a party competent to make it. In that respect his answer is simply advisory and is not binding upon the Master and might not agree, possibly, with the Master's computations and additions when he comes to go over the footings himself; but so far as the question calls for an answer from this witness which is advisory and perhaps tending to aid, the witness may answer.

Counsel for defendant notes an exception.

By the MASTER: Certainly.

A. If we consider that the selling price includes 25 per cent. profit, I find that the profit on $856,381.05 is $171,376.21.

By Mr. BAKEWELL:

459 Q. 48. I will ask the witness categorically along the same lines to add this sum on the record. Take the sum of $938,092.66, which is the total gross sales as per the tabulated statement given by Mr. Layman, assuming that the pencil memorandum on the duplicate copy of the transcript which I hand you is correct. Assuming that the total net to the Company is $856,881.05, I now ask you whether or not that would leave out, in the way of commissions to agents, the sum of $81,211.61. Answer that part of the question.

A. Yes sir, that is the agents' commission.

Q. 49. On the basis of a gross price being cost (including labor and material and everything else chargeable up to cost, which represents the total factory cost), plus 25 per cent., I ask you whether the cost would not be $750,474.13, which is arrived at by deducting one-fifth from $938,092.66?

A. No sir, I find that the factory cost is $685,504.84 and that 25 per cent. of $856,881.05 is $171,376.21.

Q. 50. What sum do you arrive at after deducting the cost from the net price to the Company of $856,881.05?

A. I find it to be $171,376.21.

Q. 51. Did you deduct one-fifth from $938,092.66?

A. No, I meant one-fifth of $856,881.05.

Q. 52. Yes, but I asked you to deduct one-fifth from $938,092.66.

A. Oh. I get $750,474.13.

Q. 53. Yes. Now please deduct $750,474.13 from the net price ($856,881.05). What do you have remaining?

A. I get $106,406.92.

Q. 54. Turning now to page 164 of Mr. Layman's deposition, we have a certain tabulated statement covering the years 1896, 1897, 1898, 1899, 1900 and 1901, and under different headings, the total volume of the Company's business for each year, the proportion of business involved in the record of this inquiry for each year and the total profits of the Company on all kinds of apparatus for each year, I find, assuming that my addition has been correct, that the total volume of the Company's business during those years amounted to $2,314,778.73; that the proportion of business involved in the record of this inquiry, given for those various years, in total, assuming my addition to be correct, is $955,271.76. I also find, under the heading "Total Profits of the Company," during the years referred to, after deducting certain losses specified on page 164 of Mr. Layman's typewritten statement, which losses are for the years 1897, 1899 and 1900, that, after deducting these losses the total profits of the Wagner Company's business during those years is $182,001.02. What proportion or percentage of the Company's total business during those years ($2,314,778.73) is the
460 proportion of business involved in the record of this inquiry (which I have given above as $955,271.76)?

Objected to as not competent, the figures given by Mr. Layman, as defendant's counsel understands it, being merely general statements showing a general profit of the Wagner defendant Company on all kinds of apparatus and there being no means given by which any profit due to transformers containing the subject-matter of claim 4 can be ascertained; it furthermore appearing from the record in this case that the Wagner Company has made transformers which do not embody the subject-matter of claim 4.

By the MASTER: Objection is overruled.

Defendant's counsel notes an exception.

By the MASTER: It is a mere matter of advisory calculation. The Master is as competent to make it as anybody.

A. I find that the proportion of transformer business to the total business is 41.26.

By Mr. BAKEWELL:

Q. 55. What do you estimate to be 41.26 per cent. of $182,001.02?
A. I find that 41.26 per cent. of the total profits is $75,093.62.

Adjourned to meet at 10 o'clock tomorrow morning.

PITTSBURG, PA., *February* 10, 1905.

Morning Session.

Met pursuant to adjournment. Parties present same as before.

Direct examination of Mr. JOHANNESEN continued.

By Mr. BAKEWELL:

Q. 56. In view of your testimony of yesterday, I will now ask you this question, which relates to the period of time covered by the accounting or report of Mr. Layman, to-wit, from June 24th, 1896, up to about November 19th, 1901, the question being as follows: During that period of time, what have you to say as to whether or not, in accordance with the practice which prevailed with the Wagner Company, there was a relation between the price of production of these transformers and the selling price of the same, and if so, what that relation was?

A. During the period in question they had a rule, which
461 was used as a base in order to arrive at the selling price, and this rule was the addition of 25 per cent. to the factory cost of production.

Q. 57. As I understood your testimony of yesterday which related to the period of time covered by the last question, and, indeed, all the questions that I have asked, tabulated and specific data was furnished the Wagner Company as to the flat cost of every item of labor and material entering into the construction of these transformers, to which was added, to cover all other expenses, from 25 to 40 per cent. As I also understood your testimony, that data was afterwards used or utilized by the Company in preparing its inventories. What have you to say as to whether or not, while you were with the Company, and during the period covered by my question, which I again repeat is from June 24th, 1896, up to and including—up to about November the 19th, 1901, those inventories were kept as records of the Company, and if so, how and where?

A. During the time that I was with the Wagner Company the inventories were kept in the office. As to how far back they were kept, I do not know, but in several instances at the taking of inventory, it was necessary for me to refer back to some apparatus—to the old inventory in order to get at the price, and in those instances, I obtained inventories which contained the same from the office.

Q. 58. How and where were they kept?

A. As near as I remember, I think they were kept in the vault.

Q. 59. Were they kept in volumes or otherwise?

A. In volumes.

Q. 60. Bound volumes?

A. Those that I refer to were bound in ordinary pasteboard covers which were made right there at the factory. The former part of your question I wish to modify or correct, where you say the itemized cost was sent to the office. This is hardly ever done. The itemized part of each piece of apparatus or transformer was kept up in the engineering office, but the totals of the itemized cost of labor and material were sent to the office.

Q. 61. The itemized costs were kept in the engineer's office?

A. As a general rule, yes, sir.

Q. 62. The total costs, you say, were sent to the office?

A. Yes sir.

Q. 63. And they were kept in the inventories, were they?

A. No, not necessarily. The costs that appear in the inventories are the cost of transformers or parts of transformers which they had on hand when the inventories were taken. As a general
462 rule, the Wagner Company had a large stock of transformers on hand, and they covered nearly the whole range of their manufacture. It would be possible, by referring to the inventory, to get at the cost of the various transformers made.

Q. 64. So it was possible, by referring to the inventories, to get at the cost of the various transformers made?

A. Yes sir.

Q. 65. On those occasions when you had reason to refer to the inventories for the purpose that you have stated, did you find that the inventories gave you the data you were looking for?

A. Yes sir. It was usually that I looked for some piece of apparatus or transformer that was on hand at the last inventory and I wanted to price it the same as it was priced the previous time.

Q. 66. You would find the price or cost of that particular part of apparatus in the inventory, would you?

A. Yes sir.

Q. 67. In your testimony of yesterday, I ascertained from you the fact that in the accounting given by Mr. Layman of transformers involved in this inquiry there had been omitted two items, to which you seemed to attach importance as matters of identification of the particular transformers set forth in that accounting, those items being the items of "voltages" and "frequencies." Is there anything which you care to add to your statement of yesterday in regard to that matter and any comparisons that you may have made by way of illustration?

A. In the comparisons of the transformers, I should have modified them and said that they would be of approximately the same frequencies and operating characteristics. This I omitted in my comparison.

Cross-examination.

By Mr. FOWLER:

X Q. 68. I understand that all the large transformers manufactured by the Wagner Company while you were in the employ of that Company had open spaces in the core. Is that correct?

Counsel for Complainant objects, that it does not appear from the testimony of this witness one way or the other on that proposition. I do understand distinctly from the record of this case, from the testimony given by Mr. Layman, that all the transformers reported in the list which we have obtained from Mr. Layman and which covers two sections, each of which covers 183 typewritten pages, and which is a report of transformers manufactured and sold
463 by the Wagner Company, the defendant in this case, and which infringe claim 4 or embody the invention of claim 4 of the patent in suit. I deny that it appears from the testimony of this witness on direct examination one way or another in regard to the question that Mr. Fowler asks. We have started out with the assumption, which was conceded to be proper, that all of these transformers embody the invention covered by claim 4, large or small. Therefore I object to the question, on the ground that it is not proper cross-examination, in the first place, and that it is utterly immaterial.

By the MASTER:

The objection is overruled. There is nothing improper in the question. The witness may answer.

A. As far as I remember, yes. Every large transformer had spacing strips,—at least that was the general practice.

X Q. 69. The Wagner Company also manufactured, while you were in its employ, a large number of transformers without open spaces in the core, did they not?

By Mr. BAKEWELL:

I submit this objection: If this line of inquiry is pursued, we will get a mass of utterly irrelevant, immaterial matter in this inquiry. We are concerned with a certain form and construction of transformer embodying the invention of claim 4 of the patent in suit, as construed by the United States Circuit Court of Appeals in New York, and as conceded and admitted and recognized by the defendants in their admissions in their answer in this case——

By the MASTER:

It is not necessary to discuss that point, Mr. Bakewell. This question is, as I interpret it, entirely outside of the list of transformers which has been furnished as embodying the patent which has been infringed upon. In so far as that is concerned, it seems to me to be wholly immaterial to this issue, unless it may possibly enter somewhat into the element of the gross expense account and gross manufacturing account of the concern, and it makes no difference whether it had or had not spaces. I do not think it is material here.

Defendant's counsel states that on yesterday this witness was asked questions relative to the transformer business of the defendant as a whole and what proportion the transformer business as a whole bore to the general business done by this defendant. The purpose of this question is to show that the defendant's transformer business was composed of transformers having open spaces in their cores and also

transformers that did not have open spaces in the core, and that therefore the [apportionment] which it was endeavored to
464 make yesterday is not sound, giving no data as to the profit which was made on transformers having open spaces in the core.

By Mr. BAKEWELL:

Nothing could be further from the fact. My friend is mistaken. My question is specific. I had the record before me and I referred to page 164 of Mr. Layman's testimony in making the inquiry. There you will find that he gives a statement, "Proportion of Business Involved in the Record of this Inquiry," and the record of this inquiry is in regard to transformers coming within the patent and not in regard to the transformer business generally. The relation or proportion that I inquired about was not in regard to the transformer business as a whole or to such transformers as they may or may not have made outside of the patent, but it related to this specific and definite statement of Mr. Layman following up that report based on "Proportion of Business Involved in the Record of this Inquiry, as Compared with the Total Volume of the Company's Business," which total volume may or may not include special transformers not within this inquiry. Nothing could be more inaccurate than the statement of my brother on the other side, and on his own statement, corrected by the record, the gentleman is concededly wrong.

By the MASTER:

We should have had the testimony taken yesterday present this morning in court in typewritten form, because we have to trust to our memories in regard to what it was yesterday. So far as my memory serves me, I think Mr. Fowler is mistaken in his assumption. The testimony yesterday, was as I gathered it, an attempt to show what was the amount of the profit derived from the business tabulated by Mr. Layman, and which is admittedly relating to the infringement, and the whole mass of business done by the Wagner Electric Manufacturing Company, without reference to whether that mass of business related to transformers or anything else. I have no recollection of anything in the testimony yesterday relating specifically to any transformer business except that included in this tabulation, and it seems to me to be wholly immaterial whether the business done outside of that tabulation, for the purpose of arriving at a valuation of the infringing business, was transformers or any other line of manufacture. Now, whether the method of arriving at the measure of damages which developed yesterday in the examination of the counsel for the Complainant is the correct measure of damages or not is an entirely different thing, but my understanding was that the comparison was made between the business done and this tabulation and Mr. Layman's testimony and the whole volume of the business done by the Wagner Company, and I have no recollection that there was anything drawn out from the witness with
465 regard to any amount of transformers which were made without the spaces and which are not included in this tabulation. Now, if the counsel for the defendant desires to go into the matter

of showing what was the particular manufacture which the Wagner Company entered into outside of this tabulation, for the purpose of arriving at the value of two methods of their manufacture,—if that is the idea, to show what were the articles manufactured beside these included in the tabulation, I would like to have the counsel make that statement and show how it could be relevant here. It seems to me that this question is irrelevant.

By Mr. BAKEWELL:

I repeat that my position in the matter is correct and my friend on the other side is incorrect in his. In the first place, I say and repeat that my statement of yesterday was based specifically by reference to the page of the record only to the "proportion of business involved in the record of this inquiry, as given by Mr. Layman in the tabulated statement on page 164." I say that all my questions on that point related to that comparison, and as proving that, I call Your Honor's attention to the record and to the addition I have made there in pencil of the various items under the last named heading for the years 1896 up to and including 1901, and which amount to $955,271.76 by my comparison or my attempt to reach a rule of proportion or the proportion of percentage that that sum bore to the sum of the "total volume of Company's business" covering those years, also given by Mr. Layman at page 164 of the typewritten record, the sum of which as I had it is $2,314,778.73, and my recollection of the testimony, and I think Your Honor will bear me out, is that the witness stated that the relation of the proportion of business involved in the record of this inquiry to the total volume of the Company's business was something over 42 per cent. and, also refreshing Your Honor's memory, under the third heading given at page 164,—you will find the third heading to be "Total Profits of the Company on all kinds of Apparatus," and under that heading Your Honor will find an alleged loss given by Mr. Layman for two years. I deducted that loss of two years from the admitted general profits of each of those years, and after deduc-ing the same, I found it to be $182,001.02, and I asked the witness to find what proportion of that profit was, according to his calculation, attributable to the "Proportion of Business Involved in the Record of this Inquiry." I repeat this statement and submit it to Your Honor that you may have your memory more clearly refreshed.

By the MASTER:

I am very sure that there was nothing in the testimony yesterday relative to other transformers outside of those in this tabula-
466 tion, and if there were anything in regard to them, it seems to me to be immaterial, because that would enter into the gross amount of all of the manufacturing done by the Company. I am of the opinion that the question is perfectly harmless, but I am confident that it is irrelevant. I shall be obliged to sustain the objection.

Counsel for the Defendant notes an exception.

By Mr. FOWLER:

X Q. 70. Did all the transformers made by the Wagner Company and priced in the list as given by Mr. Layman, that you say you have gone over, have open spaces between the coils and between the coils and the core for the circulation of oil?

By Mr. BAKEWELL:

I object to this question. I call Your Honor's particular attention to the phraseology of this question and to the phraseology of claim 4 of this patent. The gentleman has purposely avoided using the language of the claim and he is thus presenting an utterly immaterial issue, and in addition to that, this witness is not a witness who is produced for the purpose of making out any case of infringement by the defendant. We have the solemn admission of an officer of the defendant Company, to say nothing of the defendant's answer in this case, that the list of transformers involved in this inquiry, as he himself puts it in his list,—that each and everyone of those transformers embody the invention of claim 4 of this patent, and we are here before Your Honor on the decree of this Court inquiring in regard to the damages or profits by reason of the manufacture and sale by the Defendant of those infringing transformers.

By the MASTER:

What is the language of claim 4?

By Mr. BAKEWELL:

Claim 4 is in these words:

The combination, substantially as described, of an electric converter constructed with open spaces in its core, an enclosing case, and a nonconducting fluid or gas in said case adapted to circulate through said spaces and about the converter.

That is the exact language of this claim. Such a construction was found by the Court to infringe this patent. Every one of these transformers given in the list supplied by Mr. Layman, according to their own admissions, is a transformer which embodies the invention of that claim. Now, the question is utterly irrelevant and immaterial to any issue in this case, especially as put to this witness. I have put this witness on the stand simply to show that there was a certain practice which prevailed during the time covered by
467 the inquiry at the Wagner Company's place of business, by which the Company could ascertain the cost of the infringing transformers that it made.

By the MASTER:

That is all true, but it does not limit the inquiry of the other side to the purpose for which you placed this witness on the stand. Cross-examination has a superior latitude to that. The counsel is entitled to ask such a question providing it be relevant, and I am inclined to think that it might be here. He may answer the question.

Counsel for the Complainant notes an exception.

A. The greater part of the transformers given in the list were constructed with spaces between the coils, as well as between the core. Only in the very small sizes were the spacing strips between the coils omitted.

By Mr. BAKEWELL:

I understood the Defendant's counsel to admit that claim 4 is infringed where the laminated core is spaced apart, whether or not there are also spaces between the coils and the core. I understood him to admit that.

By the MASTER:

In other words, I understand the counsel to say that he admits that whether or not they are used in combination, and even if there is a separation between the coils, that the use of the separation between the coils is an infringement of the 4th. claim

By Mr. BAKEWELL:

I am contending that claim 4 covers a combination, whether or not the combination called for by that claim, in addition to having spaces between the sections of the core, also has spaces between the coils and the core.

By Mr. FOWLER:

It seems to me that the Master is not here to pass on the infringement, but to ascertain damages.

By the MASTER:

To ascertain damages, and what view I would have taken if I had been the Judge before whom—I am only to ascertain the damages.

By Mr. FOWLER:

I wanted to bring to Your Honor's attention another point. There are two coil separations: that is to say, there is a separation of the coil from the core and the coils themselves are separated. The oil circulates between the coils and the core and also circulates between the individual coils.

X Q. 71. Did not all these transformers have spaces between the coils and between the coils and the core?

468 A. As far as my recollection goes, we always tried to get the spacing between the coils, and it was only in cases where we had plenty of space that we allowed spaces between the core and the coils. In general, in all the small sizes the fit was rather close and it was impossible to get spacings between the coils. The transformers were of such size that they would dissipate their heat even without the spacing strips between the coils.

X Q. 72. I believe these small sized transformers of the Wagner Company to which you have referred in your last answer also omitted open spaces in the core, did they not?

A. Yes sir.

By Mr. BAKEWELL:

I object to that.

By the MASTER:

I think that is objectionable, because the defendant has furnished in this tabulation, according to my understanding, a list of the converters which infringed the 4th claim and it seems to me that it is irrelevant and incompetent to ask the witness—another witness—now to show that the small converters did not include the 4th claim, because it would follow, to my mind, that they are not in that list.

By Mr. FOWLER:

X Q. 73. The small transformers made by the Wagner Company, to which you referred in your last answer and which you say, when you were crowded for room, did not have coil separation, are not included in this list of Mr. Layman's, are they?

Objected to as irrelevant and immaterial.

By the MASTER:

He may answer the question.
Counsel for Complainant notes an exception.

A. In reply to that question, I can only give a general answer, and that is the smaller sizes of transformers given in the list referred to did not have spacing strips between the coils. There were a few cases where the same thing happened in larger sizes, where we were crowded for room, and in such cases we could not give spacings between the coils.

By Mr. FOWLER:

X Q. 74. As a general proposition, however, when the coil spaces were dispensed with the core spaces were omitted, were they not?

Counsel for Complainant objects. If he means to refer to the transformers or converters in this list of Mr. Layman's, that amounts to stating that under any construction of claim 4, those transformers in that list did not embody the invention of claim 4. This
469 is of the same character, under another coat, as the question put a moment ago, to which my objection was sustained.

By the MASTER:

The objection is sustained.
Counsel for the Defendant notes an objection.

By Mr. FOWLER:

X Q. 75. I understood you to say yesterday that on the larger sizes of transformers and those of the list which Mr. Layman has submitted here the Wagner Company did not keep as complete data of the cost of construction as it did of smaller transformers. Is that correct?

A. I believe you misunderstood my answer to the question referring to the itemizing of costs. I said that in the larger sizes we did

not use the same refinement in itemizing every operation as we did in the small, standard line.

X Q. 76. Coming now to the data which you say the Engineering Department have concerning the cost of labor and material in constructing Wagner transformers, I wish to ask you whether, from that data, you would be able to arrive at the cost of labor and material in providing a core with open spaces.

Counsel for the Complainant objects.

By the MASTER:

The objection will be overruled. It merely calls for a yes or no answer. It is a preliminary question.

A. There is information in the Engineering Department, at least when I was there——

By Mr. BAKEWELL:

I object to the question for this reason: take the question itself and what it inevitably must lead up to. The combination which is the subject-matter of the invention of claim 4 is an entirety of itself. It comprises a certain structure which involves a transformer consisting of the coils and the core, the core provided with open spaces in it, substantially as described in the specification of the patent, so as to open up the transformer for the circulation of oil, the oil also being in the transformer enclosed in a case which contains the oil and the transformer. The whole thing is a combination. There is no patent here on spacing strips. It is a combination as an entirety. Now, the courts have decided that the Defendant has infringed that combination—that entirety. It is conceded and admitted by the Defendant corporation here that they have used that invention to the extent illustrated and set forth by the statement presented by Mr. Layman. That being true, it is not a question of what it cost to put spacing strips between the laminæ of the core. It is
470 a question of what it cost to make that entire transformer, which as a whole they made profit upon, and that transformer has been found by the Court of Appeals as being a broad invention and broadly new and a contribution to the art. We are not dealing with a steam engine, for instance, in which there is present a valve, and a claim of the patent is on the valve, and if the valve is omitted the engine is good in other respects. We are here with an entire construction. The Defendant has selected that entire combination and they have used that entire combination, that is, the invention of claim 4. This is simply opening up with a view to trying to get this Court to say that we were only entitled to the profits that the Defendant made by reason of putting the spacing strips between the laminæ of the core, and that is equivalent to saying that claim 4 of our patent is simply on the spacing strips. The spacing strips are not there simply as spacing strips—you find the whole combination. I think this is an important question leading up to important results and I think the objection is a proper one. I think it is entirely irrelevant and immaterial to this inquiry, and I think that the objection should be sustained.

By the MASTER:

Upon that point, Mr. Bakewell, I think I stated before that I understood the difference between you gentlemen. You are claiming the matter to be an entirety, as you re-stated now. The counsel for the Defendant assumes a different basis of damages, and that is that the only damage is that which results from the use of the spacing of the core, which is the 4th claim. Now, there is a wide difference between you, gentlemen. I will be unable to learn what is the measure of damages which the Defendant assumes would be the correct measure unless he is allowed to show, if he can, what would be the cost and the profit of making the core with the spacings. I am of the opinion that the counsel for the defendant should be allowed to show, if he is able to do so, what would be the damage resulting from the use of the core with the spacings, which is covered by claim 4. In that view, I think this question is competent. It does not follow that he—that his measure of damages would be correct. I do not know what conclusions I may come to in regard to that, but the counsel is entitled to establish, if he can, a different measure of damages from that which the counsel for the Complainant assumes to be the correct one, and the Master will decide what is the correct measure, so far as he is able to do so, hereafter.

A. If the data is as complete as it was when I left, I think that I would be able to arrive at the cost of providing spaces in the core, very closely.

471 By Mr. FOWLER:

X Q. 77. Now, given a transformer having open spaces in its core and also open spaces between the coils and the core, said transformer being immersed in oil contained in the case and costing for labor and material a certain amount, I am referring to transformers in Mr. Layman's list, would you have been able to ascertain from the data which you say the Engineering Department have the cost of providing spaces between the coils and the core and separating that from the cost of labor and material of the transformer as a whole?

Objected to for the reason stated in the objection to the last question.

By the MASTER: The objection is overruled.

A. If I understand you to mean that the transformer core is to remain the same in weight, also that the coils are to remain the same in weight and every other way, it would be possible for me to arrive at the difference in cost of these transformers with and without spacing strips in their cores and coils contained in the list given by Mr. Layman.

Adjourned to meet at 2:00 o'clock p. m.

Afternoon Session.

Cross-examination of Mr. JOHANNESEN continued.

By Mr. FOWLER:

X Q. 78. Are you able to state how much would be the cost of a converter or transformer with open spaces in its core as compared with the same transformer without open spaces in its core, and you may compare any given size of transformer in Mr. Layman's list with the same transformer without open spaces in its core.

The last objection is repeated.

By the MASTER: The objection is sustained. It does not strike me that that is the point in controversy. If it is the intention of counsel for the defendant to undertake to show what the profits would be of the manufacture and sale of a core with the openings in it, it does not seem to me that the comparison is a proper one between that and an enclosed core. It is simply the question, what is the expense of the manufacture,—the production of the core with the openings in it and not the comparison between that and the closed core. There is no closed core in question here.

Counsel for the defendant notes an exception.

472 By Mr. FOWLER:

X Q. 79. Does the use of open spaces in the iron core add anything to the cost of manufacture of a transformer or is it cheaper to make a transformer with open spaces in its core than to have no open spaces in its core?

Counsel for Complainant objects.

By the MASTER: The objection is sustained.

Counsel for defendant notes an exception.

By Mr. FOWLER:

X Q. 80. Did you have anything to do with the selling of transformers when you were connected with the Wagner Company, or anything to do with the selling department?

A. All the time that I was with the Wagner Company I held two positions, the first being in the transformer testing department and later as engineer in charge of transformers. Every transformer that was made up during the time that I was engineer in charge, I had to do with the making up of the cost of that transformer and I was in a position to know the methods employed in order to arrive at the cost and selling price; that is, I knew what the practice of the Company was in order to arrive at a base for a selling price, and in a great many cases I knew what the actual selling price was.

By the MASTER: The witness has not answered the question at all.

A. No, I had nothing to do with the selling department other than to give them information as to the cost of transformers.

By Mr. FOWLER:

X Q. 81. Did you fix or have anything to do with fixing any of the selling prices of these transformers on Mr. Layman's list?

A. No, I did not have anything to do with fixing the selling price.

X Q. 82. Were the selling prices, as a matter of fact, uniform?

Counsel for Complainant objects. I do not understand what he means by "uniform." It is indefinite. It appears from Mr. Layman's list, which I presume the question contemplates, that there were various sizes of transformers.

By Mr. FOWLER: It refers to the same size and character of transformer in each instance.

A. I do not know that.

473 X Q. 83. Did you have anything to do with fixing the percentage which you say was added to the cost of labor and material of these transformers?

A. In the years included between the latter part of 1895 or the early part of 1896, until, well, in about 1899, I furnished information to the office, sometimes with that per cent. added and sometimes without it added. After that period, which I think was in the early part of 1899, I do not remember the date, the flat labor and material values were furnished only; but even after that time I knew what was added as expense to the flat labor and material cost.

X Q. 84. Do you know positively what that percentage that you have spoken of which was added to the cost of labor and material covered, except by hearsay?

A. It covered the expenses outside the actual labor which it took to make up the transformer and the material contained in it. It was supposed to cover the salaries of officers, of engineers and others in the employ of the Wagner Company who were on salaries, and also to cover all other running expenses. This information came direct to me, more than once, by the superintendent of the Wagner Electric Manufacturing Company, Mr. Schwedtmann.

X Q. 85. You do not know this, then, of your own knowledge, but all you know about it is that it was told you by the superintendent of the factory? Is that correct?

A. Yes, I had it directly from him, and he, being in charge of the whole concern, was in a position to know; and from him I learned that this percentage was arrived at by the cost of running the business the year previous to the time it was used.

X Q. 86. Was Mr. Schwedtmann in charge of the selling department?

A. Mr. Schwedtmann was in charge of the manufacturing end. He had the title of superintendent but he practically run the whole business. He had a thorough insight to every part of the business including the selling. This expense percentage was not made up by the selling department. That was my understanding of it.

X Q. 87. Now, as a matter of fact, Mr. Johannesen, did Mr. Schwedtmann have anything at all to do with the financial part of the business?

Complainant's counsel objects, on the ground that it is utterly immaterial. It appears from the testimony of this witness that Mr. Schwedtmann did have to do with the manufacturing end of the business, did know what charges went in against a transformer for flat labor and material and what percentage was added to cover all expenses, and the general practice of the Company in
474 regard to adding percentages fixing the prices. It is immaterial whether he was in charge of the finances of the Company.

By the MASTER: He may answer the question.

Complainant's counsel notes an exception.

A. So far as the manufacturing end of the business is concerned, I believe there was no other person who knew more than Mr. Schwedtmann did about it. As to whether or not he was connected with the financial end of it, I do not know, but I know he was as well posted on that side of it as any other officer of the Company.

X Q. 88. Do you know whether Mr. Schwedtmann fixed this percentage or whether someone else fixed the percentage for him—this percentage?

A. No, I do not know that, but my information about percentages came from Mr. Schwedtmann.

X Q. 89. These figures about the cost of labor and material and a percentage to be added thereto to determine the cost of production and the percentage to be added thereto to determine the selling price are regarded by manufacturers as confidential, are they not?

Complainant's counsel objects, as utterly immaterial.

By the MASTER: The objection is sustained.

By Mr. FOWLER:

X Q. 90. How long were you in the employ of the Wagner Company?

A. From the early part of July, 1893, until the latter part of September, 1902.

X Q. 91. Nearly ten years, were you not?

A. Nine years and a quarter; I came in July.

X Q. 92. In what capacities were you employed during this nine and a half years?

A. The first two years—that is, nearly two years, I was employed in the Testing Department.

X Q. 93. The transformer Testing Department

A. Yes, sir, the Transformer Testing Department. In the latter part of December, 1895, I was put down in the office. From that time on until about the time that I left the Company, I was engineer in charge of the Transformer Department. During the last year and a half, the department was divided up and I had charge of the large transformers, but nearly everything that transpired in the Transformer Department came through me. I knew what was going on in that Department all the time I was there, from the latter part of December, 1895, until I quit.

475 X Q. 94. When you left the employ of the defendant, the Wagner Company, you immediately went into the employ of the Complainant, the Westinghouse Electric & Manufacturing Company, did you not, and have been in the employ of that Company since?

A. Yes, sir.

X Q. 95. In what department of the Complainant Company, the Westinghouse Electric & Manufacturing Company, are you now, and what are your duties there?

A. In the Transformer Division of the Engineering Department. At the present time, I am designing their air-blast transformers and, also, their single-phase railway transforming apparatus; and I also, if time permits, design other types of transformers, such as water-cooled and oil-insulated large transformers.

X Q. 96. In other words you now occupy with the plaintiff, the Westinghouse Electric & Manufacturing Company, and have occupied for more than two years past, about the same position that you occupied with the defendant, the Wagner Electric Company, for nine years and a half? Is that correct?

A. It is not as broad a position as I had with the Wagner Company, because there the engineer in charge was in touch with everything that went into the apparatus he designed. In the Westinghouse Company, which is a very much larger institution, it is necessary to divide up the work under separate departments, of insulating, testing, etc., which I had charge of in the Wagner Company.

Redirect examination.

By Mr. BAKEWELL:

Re-D. Q. 97. Have you in your possession and can you produce any duplicate records or blue-prints made by you when with the Wagner Company which tend to corroborate your statements and to show the details of the expenses or flat cost of labor and material entering into the construction of transformers, and also that a certain percentage was added to the flat cost of labor and material to cover the other expenses, and if so, I would ask you to produce the same and submit the same to the Master.

Counsel for the defendant submits that this is not rebuttal.

By the MASTER: You may answer the question.

A. Yes, I have with me two blue-prints which were made from the original tracings which were in possession of the Wagner Company. I produce the copies.

Re-D. Q. 98. What are the dates on those blue-prints?

A. The date of one is July 31, 1900, and the date of the other is June 26, 1900.

476 Re-D. Q. 99. You say those are blue-prints of original tracings, which original tracings were in the possession of the Wagner Company. Are they?

A. Yes sir.

Re-D. Q. 100. You identify these as accurate blue-prints of those original tracings, do you?

A. Yes sir.

Re-D. Q. 101. Who prepared the original tracings from which those blue-prints were made?

A. The data in the blue-print was worked out by myself and my assistants, and the actual mechanical work of tracing was also done by one of my assistants.

Re-D. Q. 102. Take this blue-print of June 26, 1900, and be kind enough to point out to the Master, if you please, how specific in detail that is. Explain the blue-print to the Master.

By the MASTER: Before the witness answers I think it would be better to exhibit the prints to Mr. Fowler.

A. This blue-print, you will note, is marked "Estimated Manufacturing Cost of Type G, 100 or 200 volt Standard Transformers." It gives a table of all the sizes of that transformer which were made for that voltage. In the first column is indicated the size by number. Each number corresponds to the same as five lights or to one-fourth k. w. capacity. The first transformer No. 2 is equivalent to a ten light or one-half k. w. transformer. In the second column is given the cost of one secondary coil and it includes everything connected with that coil after it is wound and insulated. The figures all mean dollars and cents. In the second column—I mean in the third column, it gives the cost of a single primary coil; in the fourth it gives the cost of case and lid; in the fifth it gives the cost of core hangers; in the sixth it gives the end plates and end frames to hold the iron intact; in the seventh, the interchanging device, for interchanging the primary voltage of the transformer; in the eighth it gives the cost of the assembled transformer, and this cost includes all the coils assembled in the form specified there. The transformer in that shape is ready for the iron core. In the ninth column it gives cost of transformer with iron mounting and in place, including the end plates. In the tenth column it gives the cost of the transformer in the containing case, including the oil, and in the last column it gives the cost of the transformer packed ready for shipment. In all these costs an expense of 40 per cent. has been added to labor and material, and it is indicated on the sheet.

(By Mr. BAKEWELL:)

Re-D. Q. 103. Is that sheet that you have just referred to,
477 dated June 26, 1900, a fair sample of the tabulated, itemized statements that you referred to in your testimony yesterday?

A. It is a sample of those which I referred to as being in the form of tracings.

Re-D. 104. Yes. I now call your attention to the other blue-print which you produced, which bears date July 31, 1900, and ask you to explain that to the Master, if the Master so desires it, and state what that shows.

A. This sheet is made up similarly to the other, except that the expense percentages are not added. This was about the time when we changed over and gave the cost to the office without the percentages added.

Re-D. 105. That last sheet that you referred to, dated July 31st, 1900, represents merely flat labor and material values?

A. Flat labor and material values.

The blue-prints referred to are offered in evidence by Complainant's counsel, and it is asked that they be marked, in order of their dates, respectively Complainant's Exhibit, Blue-print A and Complainant's Exhibit, Blue print B.

Re-D. Q. 106. So far as the term "aging" of iron is concerned, as that term may be used in connection with transformers, what do you understand it to signify?

A. In the operation of transformers there is a certain loss occurring all the time in the core, which is due to the reversal of magnetism in the core. When the transformer is put in service, this loss is usually at its minimum,—or is at its minimum. As the transformer continues in service, this loss increases and this increase in loss is what is known as "aging" of the iron. It has been found that the "aging" of the iron is due entirely to the heating; that is, if a core operates very warm it will age more rapidly than it would if it operated cool. The designers of transformers are acquainted with this fact and in getting out the design we devise means for keeping the core as cool as we can under the existing conditions. The cooler the core operates, the longer it will take it to reach a certain amount of "aging."

Re-D. Q. 107. During the time covered by this report of Mr. Layman's, from June 24, 1896, up to and including October 19th, 1901, what have you to say as to whether or not it was recognized at the factory of the Wagner Company that there was a distinct advantage in making transformers such as those embraced in that list and which embodied in their construction the invention the subject-matter of claim 4 of the Westinghouse patent in suit, which invention, in accordance with the claim, consists in, "The combination, substantially as described, of an electric converter con-
478 structed with open spaces in its core, an enclosing case, and a non-conducting fluid or gas in said case adapted to circulate through said spaces and about the converter?

A. That fact was recognized. In designing a transformer it was, in general, the practice to allow a definite amount of space for the cooling of the core. In all the designs that I made of the type D transformers, I allowed approximately one-eighth of an inch to every inch of iron mounted. In the Type G line, the amount of space was slightly reduced, owing mainly to the length of the core, which in that type was quite short. In providing these air spaces for the core, it was necessary to add material to the coils; that is, the coils had to be made longer. Besides, the spacing strips themselves were also an extra expense.

Re-D. Q. 108. What have you to say, generally stated, as to the

recognized advantages of transformers such as those given in the list by Mr. Layman and which it is conceded embody in their construction the invention of the subject-matter of claim 4 of the Westinghouse patent in suit?

A. The advantage is both in getting cooler operation of the coils adjacent to the core and also in the core itself, both tending to retard the aging of the iron and also to reduce the operating expenses.

Re-D. Q. 109. In your cross-examination I understood you to state that, in respect to the larger sizes of transformers covered by this list, which I have so repeatedly referred to, given by Mr. Layman, you did not use the same refinement as to itemizing the cost of labor and material as you did in the other case. Please explain a little more fully what you meant by that?

A. In making up the cost of the larger sized transformer we did not subdivide it into various operations as close as in the smaller sizes. For instance, under the heading of insulation or insulating, we would consider it more as a whole than in part; that is, in more as a whole, I mean we would lump the whole insulation in one sum. Now, where it was more closely identified we would tabulate the various operations and we could take the separate coils and the parts of coils like the terminals.

Re-D. Q. 110. What have you to say as to whether or not, while you were with the Wagner Company, and during the time covered by this report of Mr. Layman's, as to these larger transformers, there was substantial data at the office of the Wagner Company to determine substantially the cost to the Company of making these larger transformers contemplated by your last answer.

479 A. There was an estimated cost given for practically every transformer sold. If they were not given in every one it was because of a closeness of duplication of the transformer to another on which cost had already been given. All of these costs, however, were not itemized; they were arrived at by the use of curve sheets. In the making up of a curve sheet, it was customary to design in detail and to estimate this cost from three to four sizes; that is, thes mallest and the largest and one or two intermediate sizes and draw a line which would pass through these costs. This curve, then, would serve the purpose of giving cost on intermediate transformers. It was possible to know the estimated labor and material on practically every transformer that was sold while I was with the Wagner Company; that is, the large size of transformer.

Re-D Q. 111. And on the small sized transformers in the manner that you have already stated,—is that not true; that is, by these itemized sheets?

A. We got out tables of cost which would be similar to these, but they were not all put on tracing cloth and they were not all itemized, but they were itemized with respect to the size, labor and material.

Recross-examination.

By Mr. FOWLER:

Re-X Q. 112. You have been asked in your re-direct examination about the recognized value of oil-cooled transformers having open

spaces in the core. I ask you if you do not know it to be a fact that the General Electric Company in its transformers uses no spaces in the iron core from 1 k. w. up to 50 k. w. transformers?

By Mr. BAKEWELL: I object to that. It does not appear that the General Electric Company has anything to do with this suit. It is indefinite.

By the MASTER: I do not think it is material, but it may be answered.

Counsel for Complainant notes an exception.

A. I am aware of that fact; but the transformer would be better if it had spacing strips in the core, as far as the aging of the iron is concerned and the operating expenses of the station after the end of a certain period.

By Mr. FOWLER:

Re-X Q. 113. You have spoken in your re-direct examination of the resistance of the iron to reversal of magnetism. Is it not a fact that when the iron is hot it has less resistance to the reversal of magnetism than when the iron is cooled?

480 A. Yes, that is a fact; but if the iron is continued in the very hot state, this loss increases more rapidly, and at the end of a certain period the loss in that transformer would be greater than it would have been if the core had open spaces in it.

Re-X Q. 114. Give an example.

A. Take, for instance, two transformers built exactly to have the same core losses, one with the spacing strips, in the core and one without the spacing strips in the core, in the first test on these transformers the core loss would be greater in the transformer which run the cooler, the one that has spacing strips in the core, at operating temperatures, but at the end of the certain period, the loss in the transformer which run the hotter, which did not have the spacing strips in the core, will exceed the loss of that with the spacing strips in the core, and this difference is due to a greater rate of aging in the transformer without the spacing strips in the core.

Re-X Q. 115. Would one or two degrees rise in temperature, or even five degrees rise in temperature, cause a substantial aging in the iron?

A. If one transformer operated five degrees hotter than another, the rate of aging would, of course, be greater, and as to the amount of that aging, I am not prepared to state.

Re-X Q. 116. Would one or two degrees rise in temperature make any substantial difference in the aging?

A. I am not prepared to answer that.

Re-X Q. 117. In order to keep the iron cool of a transformer having open spaces in its core—that is more effectively done by having the open spaces in the core vertical than disposing them horizontally, for instance, is it not?

Counsel for Complainant objects, that it is purely a matter of degree. It is immaterial as affecting the question of infringement.

By the MASTER: I do not see its pertinency but he may answer it.

A. It all depends upon the width of the lamination as to which is the most effective way. In the case very wide lamination, it is my opinion that the spacing in the core would be preferable.

Re-X Q. 118. The blue-prints which you produced on your redirect examination, and marked "Complainant's Exhibit, Blue-print A" and "Complainant's Exhibit, Blue-print B," have no items in them showing the cost of transformer cores provided with open spaces, have they?

A. The cost of the spacing strips is included in the cost given under the mounted coil. It is not specified in this print,
481 but it is contained therein. These prints here are copies of the inventory prices that I got out just before inventory time and which is put in this form so that we could price very rapidly.

Re-X Q. 119. These blue-prints which you have in your possession and which you have produced here are the property of the Wagner Company and were taken by you from the Wagner Company when you left their employ. Is that correct?

Counsel for the Complainant objects, that this is a violent assumption not warranted by anything on the record, and in the second place, the defendant is a tort-feasor, under the instructions of the Court compelled to give full and complete information in respect to the cost of producing these articles. I have Mr. Layman's statement, iterated and reiterated, that the Wagner Company has no record from which it would be possible to ascertain the cost of the various transformers in this list, and under those circumstances, and only under them, were we compelled to resort to the best evidence we can get. This gentleman has produced what he states is a copy of documents in the possession of the Wagner Company, which original documents, if Mr. Layman had answered his questions correctly, we would have had access to and from which we could have had this data.

By the MASTER: The objection is overruled. If they belong to the Wagner Company you are entitled to them. It makes no difference how they come before the Master. He can answer the question.

A. I do not see how they do belong to the Wagner Company. They are only duplicates of records that were made for the Wagner Company.

By Mr. FOWLER: That is all.

Mr. Johannesen's testimony closed. Signature waived.

THEODORE R. FOSTER, a witness produced on behalf of Complainant, being first duly sworn, testifies as follows:

By Mr. BAKEWELL:

Q. 1. Please state your name, age, residence and occupation.

A. Theodore R. Foster; Pittsburg, Pennsylvania. I am twenty-seven years old, and am an engineer with the Westinghouse Electric & Manufacturing Company.

Q. 2. How long have you held the position which you now hold?

A. Since the 19th of May, 1902.

Q. 3. Do you know Mr. Layman, who is now sitting in this room?
A. Yes, sir.
Q. 4. Waldo A. Layman?
A. I do, yes, sir.
Q. 5. How long have you known Mr. Layman?
482 A. From approximately September, 1896, until the time I resigned from the Wagner Company in May, 1902.
Q. 6. You say you resigned from the Wagner Electric Manufacturing Company, the defendant in this case?
A. Yes sir.
Q. 7. You say you resigned that Company in May, 1902?
A. Yes sir.
Q. 8. How long were you employed with the defendant Company, which I will refer to, for the sake of brevity, as the Wagner Company?
A. From approximately September, 1896, till May, 1902.
Q. 9. What were your duties during that term of employment with the Wagner Company—from the time you commenced your employment until you resigned?
A. When I first entered the employ of the Wagner Company and for several years thereafter I assisted Mr. Johannesen, the transformer engineer, in the preparation of engineering data relative to transformers, also working up costs in detail; and, after approximately two years, I was transferred to the factory and held the positions in charge of the various transformer testing departments for approximately a year and a half. I was then transferred back to the engineering office and assisted in designing transformers, keeping the transformer test records, etc., and after a short time, was again transferred as the head of what was known as the Production Department and Quotation Department, which position I held until I left the employ of the Company, approximately May 15th, 1902.
Q. 10. Is the Mr. Johannesen that you have referred to the gentleman in the room who has already testified?
A. Yes, sir, he is.
Q. 11. While you were in the employment of the Wagner Company, the defendant in this case, did you know a Mr. Schwedtmann?
A. Ferd. Schwedtmann? He was the general superintendent; I knew him well, yes sir.
Q. 12. General Superintendent of the Wagner Company?
A. Yes sir.
Q. 13. What were Mr. Schwedtmann's duties as General Superintendent, if you know?
A. Mr. Schwedtmann had direct supervision of or over the factory and was also connected with the affairs of the office relating to the sales of apparatus of all classes, including motors, transformers, switchboards, instruments, and any other apparatus which may have been manufactured by the Wagner Company.
Q. 14. Have you examined the report or transcript furnished to us in this case by Mr. Layman of the Wagner Company,
483 which is in two sections, covering about 183 typewritten pages, and which purports to give a list of transformers em-

bodying the invention of claim 4 of the Westinghouse patent in suit made and sold by the Wagner Company between June 24th, 1896, and November 19th, 1901? I simply ask you if you have examined it.

A. Yes sir, I have examined the papers referred to.

Q. 15. During the period covered by that report, at least from your employment with the Wagner Company in September, 1896, what have you to say as to the practice which prevailed with the Wagner Company in the matter of ascertaining costs of transformers, such as those, for instance, enumerated in this list of Mr. Layman.

A. The various items which go to make up the various transformers,—the various sizes of transformers, were carefully priced, and after adding together all items occurring under labor plus all items occurring under material, the result gave, in all cases, the costs of the different sizes of transformers.

Q. 16. That cost which you have referred to, then, was the flat cost of labor and material, was it?

A. Yes sir, the flat cost of labor and material.

Q. 17. Having ascertained from you by the last question what you mean by the flat cost, state, if you please, and if you know, during the period contemplated by my last question, what practice, if any, prevailed with the Wagner Company in respect to adding anything else to the flat cost of labor and material entering into the manufacture of these transformers?

A. After the flat cost of labor and material had been ascertained, the practice was to add a certain percentage to cover the fixed expenses of the Company, including salaries, selling expense, &c. This percentage varies, within certain limits, from approximately 25 per cent. to 40 per cent. During the last two years, approximately, that I was with the Wagner Company, I can state positively that the percentage added to the flat labor and material was 40 per cent.

Q. 18. I will ask you now whether that practice which you have referred to of an estimated cost called flat cost of labor and material plus a certain percentage varying from approximately 25 per cent. to 40 per cent. applied only to transformers made and sold by the Wagner Electric Company or to the entire product of the Wagner Company.

A. The percentages were added to the costs,—that is, flat labor and material, of all apparatus manufactured by the Wagner Company.

484 Q. 19. Now, we have the practice which prevailed so far as the flat cost of labor and material is concerned plus a certain percentage to cover the general expenses of the business. I now ask you what practice, if you know, prevailed at the place of business of the Wagner Company, not only in respect to transformers, but all other apparatus manufactured by the Wagner Company, in making up the selling price of articles manufactured by it, including transformers?

A. As to the percentages added to the factory cost during the early part of my connection with the Wagner Company, I am not in a position to state exactly what this percentage was, but by comparisons made between the costs of the transformers, as shown on

the general orders and correspondence which was referred to the Engineering Department, it would approximate 25 per cent. However, during approximately the last two years of my connection with the Wagner Company, the percentage was invariably 25 per cent. with the exception of switchboard apparatus, which had 20 per cent. added to the factory cost.

Q. 20. Then, by "factory cost" in your last answer you mean what was considered the total cost, including flat labor and material plus that certain percentage added chargeable to the general expenses of the business?

A. Yes sir, that is the factory cost.

Q. 21. And the percentages that you spoke of added to fix the selling price were percentages added to that which you have designated in the manner stated as the factory cost? Am I right?

A. Yes sir, that is correct.

Q. 22. In your last answer but one, I understood you to state that there was more exactness in regard to percentages in the last two years of your employ than in the previous years. Was that due to the difference in the position you held in the last two years, or to what?

A. During approximately the last two years I worked very closely in touch with Mr. Ferd. Schwedtmann, the superintendent, and it was through him I obtained the percentages that were added to the various apparatus manufactured.

Q. 23. Please examine the blue-prints "Complainant's Exhibit Blue-print A" and "Complainant's Exhibit, Blue-print B," which were introduced in evidence in connection with the testimony of Mr. Johannesen, and state whether or not you have seen similar records while in the employment of the Wagner Company.

A. I have seen copies of blue-prints identical with these while in the employ of the Wagner Company, and, further, in adding to the inventory the price of transformers completed or in state of construction, I used a print identical with that marked "Com-
485 plainant's Exhibit, Blue-print A," which shows the percentage added to the flat labor and material necessary to obtain the factory cost.

Q. 24. Were such records as those which I have referred to in my last question and exhibited by "Complainant's Exhibit, Blue-print A" and "Complainant's Exhibit, Blue-print B" records regularly kept by the Wagner Company while you were in their employ?

A. All records were carefully preserved during the time I was with the Company, and, if not made up into tracing form, were carefully tabulated and copied into the various books kept for this purpose, which were on file in the Engineering Department. In some cases, where an urgent request was received from the office for a price on a certain transformer, it was sent through to the proper party, but no record was kept in the Engineering Department. However, if the order for the transformer covered by the price sent to the office was secured, the information in the Engineering Department was in such a form as to enable the price to be readily ascertained.

Q. 25. You spoke in your last answer to this effect, as I understood

you, that where tracings, by which I understand you to mean linen tracings or drawings of schedules, such as "Complainant's Exhibit, Blue-print A" and "Complainant's Exhibit, Blue-print B," were not kept, the records of the cost of manufacture of such transformers not preserved in the way of tracings were otherwise carefully transcribed and preserved in the records. Now, I am going to ask you how, if you know, records of tracings containing such data as is found on these blue-prints was preserved—were preserved by the Wagner Company while you were there, if you know.

A. The tracings in nearly every case were made up under the direction of Mr. Johannesen and were, I believe, filed by him in the transformer division of the Engineering Department.

Q. 26. I understood you to state in your testimony that you had occasion while in the employment of the Wagner Company to examine just such data as that illustrated, as an example, by "Complainant's Exhibit, Blue-print A" and "Complainant's Exhibit, Blue-print B;" what were your occasions for examining such data, and for what purpose were such examinations made by you while in the employment of the Wagner Company?

A. During the time I was with the Wagner Company it was the practice to take an inventory of all apparatus in the factory on approximately January 1st and July 1st of each year. This list, when made up, was sent to the Engineering Department to have all the items appearing thereon priced, and in order to arrive at the necessary or at the proper price for the various sizes and kinds of
486 apparatus, it was necessary to refer to the tables of prices made up and which covered the apparatus in its various stages of construction. The statement above applies more particularly to transformers, as the items appearing on the inventory relative to other apparatus were also priced in the departments where the apparatus was made and also by the Purchasing Agent, Mr. Ralph Bowman.

Q. 27. Well, then, as I understand your testimony, it was in connection with preparing the inventories that you had occasion to refer to such data as that illustrated by the two blue-prints that I referred to.

A. It may have been necessary on other occasions, between inventory times, to refer to such sheets to obtain any information desired in connection with the apparatus.

Q. 28. But it was also necessary in connection with making the inventories, was it?

A. Yes sir, it was.

Q. 29. While you were with the Wagner Company, do you know whether or not these inventories which were made up every half year, as you have stated, were preserved, and if so, in what form were they preserved by the Wagner Company?

A. In going through an inventory, say, taken July 1st, of one year, certain articles of apparatus would be found, and in order to arrive at the price at which the same should be entered, reference was made to the inventory taken six months previous, and which was filed in the vault in the office, and which was, to the best of my belief, provided with heavy cardboard covers and the pages suitably

bound together at one of the book binding establishments in St. Louis.

Q. 30. In other words, those inventories were kept in the vaults of the Wagner Company as records?

A. To the best of my knowledge they were.

Q. 31. Did you ever have occasion to examine them and see if they were?

Objected to as leading and as being of the nature of cross-examination rather than direct examination.

By the MASTER:

It must be restricted to the rules of direct examination, but you may answer the question.

A. I have had occasion to examine the books at various intervals, and on such occasions found the books on file in the vault of the Company.

Q. 32. You mean the inventories?

A. The inventory books.

Adjourned to meet at 10 o'clock tomorrow morning.

PITTSBURG, PA., *February* 11, 1905.

Morning Session.

Met pursuant to adjournment. Parties present same as before.

487 Direct examination of Mr. FOSTER continued.

By Mr. BAKEWELL:

Q. 33. Please state, generally, what these inventories in these bound volumes showed and from what data they were compiled during the time that you were with the Wagner Company and familiar with the inventories.

A. On approximately January 1st and July 1st of each year, it was the custom to make a record of every piece of apparatus in the factory at that time, whether in a complete or in an incomplete state, and after this record was made, the various items, as shown, were priced with the flat labor and material plus the percentage, which gave what is known as the factory cost. These records, after being priced, were suitably bound and filed in the vault.

Q. 34. Those constituted the inventories, as I understand it. Did they?

A. Yes sir.

(By the MASTER:)

Q. 35. Same as annual stock taking?

A. Yes sir.

(By Mr. BAKEWELL:)

Q. 36. Those records, as I understand it, were preserved?

A. They were, yes sir.

Q. 37. A subject of reference when desired?

A. Yes sir, I always found it to be the case.

Q. 38. What, if anything, did you have to do during the term of your employment with the Wagner Company, or during any part of your employment with the Wagner Company, in the matter of making prices on articles manufactured and sold by the Wagner Company, including transformers?

A. During the existence of the sales organization from approximately May 1st, 1901, until the time I left the employment of the Company, I made quotations direct to the various district offices, as well as to the proper parties in the office of the Wagner Company, covering all types or classes of apparatus manufactured and these prices were made up from the actual cost of labor and material which was furnished to me by the engineers in charge of the various departments in which the different lines of apparatus were made, and to this flat labor and material I added the necessary expense to arrive at what was known as the factory cost, which in every case was 40 per cent., and to the result was added certain percentages, which were generally 25 per cent., with the exception of switchboard work, to which 20 per cent. was added, and these prices were then the prices received by the Wagner Company for the sale of the apparatus.

488 By the MASTER:

Q. 39. How do you account for the difference between 25 per cent. added to express the factory cost in the earlier years and 40 per cent. being added in the last two or three years? Is that the result of increase of salaries?

A. The result of increase in the business and expense.

By Mr. BAKEWELL:

Q. 40. If the business enlarged in accordance with increase in expense that would not be necessary; the proportion would be the same. Whether it was an arbitrary increase in the factory cost, due to increase of salaries or such expense which did not bear any pro rata to the increase of business and increase of employes?

A. The percentages that were added to the flat labor and material were in every case added upon authority of either Mr. Ferd. Schwedtmann, the General Superintedent, or someone in authority in the office force.

By the MASTER:

Q. 41. The point is whether that was an arbitrary addition to reach the factory cost based upon something else than the actual expenses of the business inclusive of salaries of officers.

A. The percentages as added were fixed by officers of the Company, and as just why the percentages were changed from time to time, I am unable to state.

Q. 42. Are you able to state when the change was made from 25 to 40 per cent.?

A. The change was not made from 25 to 40 per cent., as at one

time a percentage of 33½ was added. However, during the time that I was connected with the Company and worked in touch with M-. Schewedtmann, I am in a position to state that the percentage added was 40 per cent. This dated from the early part of the year 1900.

By Mr. BAKEWELL:

Q. 43. But whatever the percentage was that was added, whether 25, 33½ or 40 per cent.. it was an arbitrary percentage added for the purpose of covering all expenses over and above the flat labor and material cost, was it?

A. Yes sir, it was.

Q. 44. Please look at this letter which I hand you and tell what, if anything, you know about it.

A. This is a copy of a letter received by me from Mr. Layman on August 6, 1901.

Q. 45. What do you mean by a copy, a copy of the letter or the original?

A. It is a carbon copy of the original.

Q. 46. When was that letter received by you?

489 A. By referring to the copy I can make answer as to the exact time, which is noted at the bottom.

Q. 47. You say there is a memorandum on the bottom in your handwriting?

A. Yes sir, a memorandum in my handwriting at the time it was received.

Q. 48. What is the memorandum?

A. This memorandum states that the letter was received by me at 4:30 p. m., August 6, 1901.

Q. 49. At that time you were in the employment of the Wagner Company, the defendant in this case, were you?

A. Yes sir, I was.

By Mr. BAKEWELL: As a matter of convenience and preserving the record, I would like to offer the letter in evidence and to have it read into the record.

The letter offered is marked "Complainant's Exhibit, Layman Letter A" and is read in evidence as follows:

"AUG. 6, 1901.

Mr. Russell:
Mr. Thomas:
Mr. Delafield:

The only factory employee authorized to make prices to the Sales Organization is Mr. T. R. Foster, and you will please not attempt to quote on the outside on a basis received from any other factory source. Authorized quotations to the Sales Organization will come from Mr. Schwedtmann, Mr. Foster, or the writer.

Yours truly, W. A. LAYMAN.

Copies sent to Mr. Schwedtmann, Mr. Foster, Mr. Roberts.

Quotation Dep't. Received by T. R. F. Hour 4:30 p. m. Aug. 6, 1901. Referred hour — M. To —— ——."

A. (continued.) On the lower left-hand corner appears "Copies sent to Mr. Schwedtmann, Mr. Foster. Mr. Roberts."

Q. 50. What other memorandum is there, if any, on the letter?

A. There is also a memorandum appearing thereon, the items being filled in by me on an impression made from a stamped form showing the time of day and the date when I received the letter. It is as follows: "Quotation Dep't. Received by T. R. F. Hour 4:30 P. M. Aug. 6, 1901. Referred hour — M. To —— ——."

490 Q. 51. In whose handwriting are the initials T. R. F.?

A. The initials T. R. F. appearing on the sheet are in my handwriting. They stand for the initials of my name, Theodore R. Foster.

Q. 52. They are yours?

A. Yes sir.

Q. 53. Who is the Mr. Schwedtmann referred to in this letter?

A. General Superintendent of the Wagner Company at that time.

Q. 54. Who is the Mr. Roberts referred to in that letter?

A. Mr. Roberts was a member of the office force and his duties were in connection with the records of the Wagner Company from an office standpoint.

Q. 55. Who is the Mr. Russell referred to?

A. Mr. Russell, at the time that letter was written, was Assistant Manager of the Sales Organization of the Wagner-Bullock Companies.

Q. 56. Who is the Mr. Thomas referred to in that letter?

A. Mr. Thomas was connected with the Sales Organization at the time that letter was written.

Q. 57. Who is the Mr. Delafield referred to in that letter?

A. Mr. Delafield was a salesman of the Sales Organization.

Q. 58. Is this letter now in the form in which it was received by you at that time?

A. Yes sir, it is.

Q. 59. What, if anything, do you know about the document which I now hand you?

A. This is the original of a letter received by me on June 1st, 1901, from Mr. Ferd Schwedtmann.

Q. 60. From Mr. Schwedtmann of the Wagner Company?

A. Yes sir, Mr. Ferd. Schwedtmann of the Wagner Company.

Q. 61. He is the Mr. Schwedtmann you have referred to?

A. Yes sir.

Q. 62. What was his position at that time?

A. His position was that of General Superintendent.

Q. 63. Has that letter been in your possession since its receipt?

A. Yes sir, it has been in my possesion since it was received.

Q. 64. How is that letter signed, in pen and ink or in typewriter?

A. It is signed in typewriter, which is the practice of signing all such memorandums during the time I was with the Wagner Company.

By Mr. BAKEWELL: I now offer in evidence the letter which has been identified by the witness, dated June 1st, 1901, addressed to

T. R. Foster, signed F. Schwedtmann, and ask the privilege
491 of reading the same onto the record simply as a matter of convenience, and I ask that the exhibit be marked by the Master "Complainant's Exhibit, Schwedtmann Letter B."

The letter is marked as requested and read in evidence, as follows:

"JUNE 1ST, 1901.

Mr. T. R. Foster:

In order that we may thoroughly understand each other on the subject of quotations to the Sales Organization, and estimates for the Wagner Company, we wish to confirm our understanding of our conversation on this subject as follows:

All quotations for apparatus coming from the Engineering Department must go through your hands, and you will see that quotation numbers are printed on each sheet attached to such quotation. The different departments will be indicated by the first letters, as talked over. Each department is to have its own series of numbers; the switchboard department, which has already up to a high number, can continue the present series, the other departments should begin with 20, in all respective series, so that estimates that have been gotten out within the last few weeks, can be numbered if such is found possible.

You will attend to making out quotations at the present time for all switchboard work, and all special transformer work. Instructions as to the percentage to be added, need not be repeated in this letter. Special Motor work, and Instrument work we would like to have you take care of as soon as you see your way through it, until such a time Mr. Layman or I will take care of it.

In making a quotation of special transformers, please bear in mind that many times a great deal of information is necessary and that this information should be given in such a manner that it will n-t have to be rewritten. In other words, look it over with Mr. Johannesen, and after that arrange to have efficiencies, iron and copper losses, capacities, and all other engineering data put on one sheet. This sheet should be made out in triplicate, and a small slip should be added by Mr. Johannesen giving the cost of such apparatus. You can keep one of the copies of the Engineering information together with the cost slip, and send the other to the Sales Organization with your quotation, always referring your proposition to engineering information as per attached sheet.

The Sales Organization will do the same thing, and in this manner, have the original copy for our customer, the second copy for their own records, and you have the third copy for your records. This I believe should be carried through not only in the Transformer work, but all through the apparatus where a great deal of writing is necessary, as for instance in switchboards.

492 Please bear in mind in connection with this matter as well as in all others that one of the first principles of doing a great deal of work is to avoid repetition. This will not only save time for everyone connected, but also errors due to wrong interpretation of poor figuring. I shall give instructions to Mr. Pills-

bury, Mr. Johannesen, Mr. Jeannin and Mr. Begole asking them to send over all matters to your desk for estimate numbers. Anything further that suggests itself to you in connection with this, kindly take up with us at once. It is the man who is doing the actual work who will oftentimes have the most up-to-date ideas on any particular subject.

Yours truly,

F. SCHWEDTMANN."

By Mr. BAKEWELL:

Q. 65. In the third paragraph of this letter which has been just offered in evidence and read into the record, I find the following: "You will attend to making out quotations at the present time for all switchboard work, and all special transformer work. Instructions as to the percentage to be added, need not be repeated in this letter." What percentages are there referred to, if you know?

A. The percentages referred to were the adding to the actual labor and material of 40 per cent, to make what is known as the factory cost and the adding to this percentage of 20 per cent. in the case of switchboard work and 25 per cent. in the case of transformer work, which were the prices received by the Wagner Company for the sale of the apparatus mentioned.

Q. 66. During the time that you were in the employment of the Wagner Company, would it have been possible for you, from the way the records were then kept, to have determined, if you were asked in any particular case, from the records of the Wagner Company, what the cost as well as the selling price was of any article manufactured by the Wagner Company, including transformers?

A. It was possible to get this information during the time I was with the Company, and more especially in reference to transformers, as the price covering the same were very carefully worked up and the information was in such a shape as to enable you to get the information desired.

Q. 67. That information was found in the records of the Company, was it?

A. Yes sir, the information was contained in the records of the Company.

Q. 68. I now call your attention to a letter which I now
493 hand you. State what, if anything, you know about that letter.

A. This is a mimeograph copy of a circular letter issued by the Wagner Company on November 19th, 1901, and signed by Mr. W. A. Layman.

Q. 69. In the transcript of what purports to be an account of transformers made and sold by the Wagner Company between June 24th, 1896, and November 19th, 1901, such transformers embodying the invention of claim 4 of the Westinghouse patent in suit, which transcript or record was furnished to the Master by Mr. Layman,—I understand from Mr. Layman's testimony that the transcript stopped at November 19th, 1901, on the theory that after that time the Wagner Company did not manufacture or sell

transformers embodying in their construction the invention claimed by claim 4 of the Westinghouse patent. Now, by reference to the letter which you have just referred to and which you have in your hand, I will ask you whether at the time that letter was written or bears date, before the date of that letter or afterwards, you had received information or instructions from Mr. Layman or from anyone connected with the Wagner Company that they had ceased to manufacture or sell transformers embodying in their construction the invention of claim 4 of the Westinghouse patent, which claim is in the following words: "The combination, substantially as described, of an electric converter constructed with open spaces in its core, an enclosing case, and a non-conducting fluid or gas in said case adapted to circulate through said spaces and about the converter."

A. I had never received instructions, either before or after November 19th, 1901, to the effect that the Wagner Company had discontinued the manufacture or sale of transformers embodying the claim as set forth in claim 4 referred to.

Q. 70. Did you receive instructions on the date of that letter to that effect?

A. No sir, I did not.

Q. 71. Has that letter been in your possession since you received it?

A. Yes sir, it has.

Q. 72. When did you receive it?

A. November 19th, 1901.

Counsel for Complainant now offers in evidence the letter referred to by the witness and asks that it be marked "Complainant's Exhibit, Layman Letter C" and asks that, for the purpose of convenience, the stenographer copy the said letter into the record.

The letter is marked as requested and read in evidence
494 as follows:

"NOVEMBER 19TH, 1901.

St. Louis Office Circular Letter No. 2049.

Re: Transformer Litigation.

To All Agents:

Gentlemen:

It has perhaps been brought to your attention, through the daily papers or otherwise, that Judge Hazel, of the United States Circuit Court for the Western District of New York, handed down last week an opinion against this Company in two transformer suits brought against the Union Carbide Company, of Niagara Falls, N. Y., one by the Westinghouse Company and the other by the General Electric Company. This information is correct. The Wagner Company will at once appeal both cases, and it is the opinion of our Patent Counsel that it is as near a certainty as anything of this sort can be that the Court of Appeals will reverse Judge Hazel in both cases. The patents involved cover details of construction, not in any sense the fundamental principles of the static transformer.

Our case in the lower Court was very ably presented by our Patent Counsel, Messrs. Fowler & Bryson.

Should any of your customers ask you for an explanation of the matter, you may assure them that the litigation involves details of construction only, that this Company has appealed from the decision and that we believe it to be a certainty this decision will be reversed. Neither patent involves, from our point of view, either novelty or improvement over the previous art.

Yours very truly,

WAGNER ELECTRIC MANUFACTURING CO.,
W. A. LYMAN, *Ass't Gen'l Mgr.*"

Dic. W.A.L.-A.F.C.

By Mr. BAKEWELL:

Q. 73. Referring now to the transcript of the account given by Mr. Layman of transformers made and sold by the Wagner Company during the period covered between June 24th, 1896, and November 19th, 1901, all of which transformers embody the invention the subject-matter of claim 4 of the Westinghouse patent in suit, I ask you to state whether or not in that transcript, in respect to each transformer, the voltage and frequency is given.

A. The voltage and frequency are not given in the lists
495 referred to.

Q. 74. Would the giving of the voltage and frequency with respect to each transformer be of any assistance in determining the actual cost of each transformer?

A. The voltage and frequency would be necessary in order to determine the cost of any sized transformer as shown in the list referred to. The costs of transformers vary with a change in frequency or voltage within certain limits.

Q. 75. During the time that you were with the Wagner Company, did the records in respect to these transformers manufactured and sold by the Wagner Company also contain a record of the voltage and frequency of the transformer?

A. They did contain a record of voltage and frequency, as this information was necessary before transformers could be designed or shipped.

That is all.

Cross-examination.

By Mr. FOWLER:

X Q. 76. What business were you engaged in before you entered the employ of the Wagner Company?

A. At the time I entered the employ of the Wagner Company I was in no business at all.

X Q. 77. How old were you when you entered the employ of the Wagner Company?

A. As near as I can remember, 18 years.

X Q. 78. How old are you now?

A. I will be 28 years old my next birthday.

X Q. 79. And you were in the employ of the Company how long?
A. From September, 1896, to May 15th, 1902.
X Q. 80. About six years?
A. Yes sir.
X Q. 81. Are you an electrical engineer, Mr. Foster?
A. Not from having attended college, no sir.
X Q. 82. How did you become an electrical engineer, making up price lists?

Counsel for Complainant objects. A man might be a good lawyer without attending law school.

By the MASTER:

The question is admissible.

A. During the time that I was with the Wagner Company and in the testing department my ability was recognized by the Wagner Company to the extent that I had absolute charge of the testing of all transformers during a certain period. Outside of information gained here, I studied very energetically and therefore increased my knowledge of electrical apparatus.

496 X Q. 83. What were your duties in this testing department—in this testing of transformers? What did you do about the testing?

A. It was necessary to make complete tests on the transformers, such as iron loss, copper loss and any other testing required, and also the running of temperature tests, which was necessary in order to know that the transformer would be within the temperature guarantee given to the company buying the apparatus.

X Q. 84. I understand, then, that you put in the circuit of the transformer electrical measuring instruments and that you read these instruments and made a note of them and that you also tested the temperature of the oil by thermometers. Was that the testing you did?

A. That does not state the matter clearly as it really was. In order to arrive at the temperatures of transformers—thermometers usually gave inaccurate results in many cases—the resistance was taken by means of a wheatstone bridge or by a fall of potential method.

X Q. 85. How do you spell this word "wheatstone?"
A. W-h-e-a-t-s-t-o-n-e.

X Q. 86. So that your duties were in addition to taking the thermometer tests on transformers, to apply electrical measuring instruments to those transformers and measure the performance of the transformer. Is that correct?

A. It is correct, but that did not constitute all the duties in connection with my having charge of the Testing Department. During a considerable part of the time, while I had charge of this work, I had, among other men in my force, two college graduates, Mr. L. J. Bellnap and Mr. Zentaro Iijima.

X Q. 87. Did you have anything to do with the design of transformers?

A. Yes sir, I did.

X Q. 88. What did you have to do with the design?

A. After having had charge of the Testing Department for a certain length of time, Mr. Johannesen took the matter up with Mr. Schwedtmann, the General Superintendent of the Wagner Company, in an endeavor to have me given a more remunerative position, and in this connection I was transferred back to the engineering department, transformer division, and under Mr. Johannesen's instructions, went into the design and construction of transformers.

X Q. 89. What are your duties now with the Westinghouse Company?

A. My duties are in connection with the publishing division—the publication division of the engineering department of the Westinghouse Electric & Manufacturing Company.

X Q. 90. Have you ever designed any transformers for the Westinghouse Company?

497 A. No sir, I have not. My duties simply lie in preparing technical information for the guidance of the agents in the sale of apparatus manufactured by the Westinghouse Electric & Manufacturing Company.

X Q. 91. Are you a member of any electrical society,—engineering society?

A. I am not a member of any electrical society, but I have been ap-roached on several occasions to become a member of the American Institute of Electrical Engineers.

X Q. 92. I notice that one of the letters which you have produced, and which has been offered in evidence, and which is marked "Complainant's Exhibit, Layman Letter C," is addressed "To all Agents." You were not an agent of the Wagner Company, were you?

Counsel for Complainant objects, that it is utterly immaterial. He has identified the letter as a circular letter issued at that date.

By the MASTER:

It is all in cross-examination, to test the capacity of the witness and his position and standing.

A. I was not an agent of the Company, so to speak, but in a great many instances copies of circular letters were sent to me by the Assistant Manager of the Sales Organization, Mr. R. J. Russell.

X Q. 93. How did you obtain possession of this particular letter?

A. The letter is one of those that were sent to me in the manner I have outlined above.

X Q. 94. You mean you received it from Mr. Russell?

A. As Mr. Russell furnished me with copies in a great many cases of circular letters, it would seem evident that this letter came from the same source.

X Q. 95. But you are unable to state of your own knowledge that this letter did come from Mr. Russell, are you?

A. This letter is one of a series issued by the Sales Organization, and it would appear as though this letter came from the source mentioned.

X Q. 96. I did not ask you that. I asked you if you could state positively that that letter came from Mr. Russell.

A. I cannot state positively that that letter was sent to me by Mr. Russell direct.

X Q. 97. Mr. Russell was connected with the Sales Organization, was he not?

A. Yes sir, he was.

X Q. 98. And this letter to which I call your attention was issued by the executive department of the Wagner Company, was it not, and not by the Sales Organization?

498 A. It was made up by an executive officer of the Wagner Company, but it was issued as one of a series of letters gotten out by the Sales Organization and the number in this case is 2049.

X Q. 99. Have you in your possession copies of all these series of letters which you say were issued by the Sales Department?

A. No sir, I have not.

X Q. 100. Have you any others?

A. To the best of my knowledge, no sir. At the time I left the Wagner Company the only information that I took was information which would not affect the Wagner Company as far as I was concerned, as up to the present time no information that I may be able to get hold of has been disclosed by me to anyone.

X Q. 101. Are these letters which you have produced here all the letters which you have, issued from the Sales Department?

A. No sir, I have several other letters.

X Q. 102. How is it that you kept the copy of the letter addressed to the agents of your former employer, the Wagner Company, and pertaining to patent litigation?

A. It may have been simply due to the fact that I was interested in the outcome of the suit, being at that time an employé of the Wagner Company, and at the time the decision was rendered, if I am not mistaken, it resulted in the laying off of a number of engineers. This, however, may have been due to another decision of the Court, affecting, as I believe, the Stanley Company which was decided some little time after this date.

X Q. 103. So that you are not able to say that anybody was laid off by the Wagner Company by reason of the decision in this case?

A. No sir, I am not.

Signature waived.

Testimony Closed.

I hereby certify that the foregoing is a full, true and correct transcript of my notes of testimony in the above stated case and that the same was correctly reported by me.

J. C. MORSE.

ST. LOUIS, *March* 24, 1905.

The parties met pursuant to adjournment as above, on March 24, 1905, at half past ten o'clock in the forenoon of that day, at the offices of Mr. Paul Bakewell, Chemical Building, St. Louis, Missouri.

Present: Mr. Henry H. Denison, Special Master; Mr. Paul Bakewell on behalf of the complainant; and Mr. A. C. Fowler on behalf of the defendant; when the following proceedings were had:

499 Mr. Bakewell, on behalf of the complainant, presents herewith a written statement, signed by solicitors for the complainant, the original of which was presented to the Master, and a carbon copy of the same given to defendant's counsel; and in connection with said statement declares that complainant's proofs in chief upon this accounting, are now closed; and asks that the typewritten statement may be made a part of the record.

Thereupon, by consent of parties, the Master adjourned the further hearing herein to Friday, April 7, 1905, at the offices of defendant's counsel, Mr. A. C. Fowler, Commonwealth Trust Company Building, in the City of St. Louis, Missouri.

ST. LOUIS, *April 7th*, 1905.

The parties met pursuant to adjournment as above, on April 7th, 1905, at half past ten o'clock in the forenoon of that day, at the office of Messrs. Fowler & Bryson, Commonwealth Trust *Company*. In the absence of Mr. Bakewell, Counsel for the Complainant, who was out of town, no testimony is presented at this hearing.

Defendant's counsel understands from the written statement submitted by Complainant's counsel at the last session in connection with the closing of Complainant's proof, that Complainant waives all claim as to damages in this case, but claims that Complainant is entitled to certain profits which the Defendant has made.

Defendant's counsel requests and moves the Master to find that the Complainant has not shown any profits due to the patented invention, and in view thereof Defendant's counsel requests and moves the Examiner to find that the Complainant is entitled only to nominal or no profits, and, therefore, Defendant's counsel requests and moves the Examiner to find that the Complainant should pay all costs of this reference.

Defendant's counsel requests the privilege of filing a written brief and argument in support of the above at or before the next session with leave, of course, to Complainant's counsel to reply thereto.

Defendant's counsel makes the above motion with the understanding that he does not waive his right, should the Master rule against the motion, to present testimony for the Defendant in this case.

500 At this point the further hearing was adjourned to Tuesday, April 18th, 1905, at the office of Fowler & Bryson at 10:30 a. m., Commonwealth Trust Bldg.

Circuit Court of the United States, Eastern Division of the Eastern Judicial District of Missouri.

No. 4457. In Equity.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, Complainant,

vs.

WAGNER ELECTRIC MANUFACTURING COMPANY, Defendant.

Accounting before Henry H. Denison, Esq., Master.

Statement of Complainant's Counsel in Connection with the Closing of Complainant's Proofs in Chief on the Accounting.

The record of proofs on behalf of complainant on this accounting has been taken down stenographically before the Master and then reduced to typewritten form, the ribbon copy being for the permanent record and the carbon copies thereof supplied to complainant's and defendant's counsel. This record consists of Mr. Waldo A. Layman's testimony, with record of meetings and adjournments before the Master, consisting of sixty-nine typewritten pages; it also consists of an account produced by Mr. Layman during his examination, purporting to be made up from the books of the defendant corporation, which is in two sections of typewritten pages, each section covering 183 typewritten pages. The record also consists of the testimony of Mr. Svend E. Johannesen and Mr. Theodore E. Foster, which was taken before the Master at Pittsburgh commencing on February 9, 1905; and the record of Mr. Johannesen's and Mr. Foster's testimony covers eighty-six typewritten pages. Certain exhibits were also introduced in evidence in connection with the testimony of Messrs. Johannesen and Foster.

The record produced by Mr. Layman of infringing transformers, and which, as before stated, is made up of two sections, each of which covers 183 typewritten pages, is supposed to cover, according to Mr. Layman's statement, all infringing transformers made and sold by the defendant since June 24, 1896,—six years before the bill of complaint in this case was filed.

With the foregoing record and the exhibits introduced in connection therewith before the Master, I desire here to announce that complainant rests its prima facie case on this accounting in connection with the following statement:

501 If we have correctly added up the columns of figures on the various pages of the transcript furnished by Mr. Layman, up to and including pages 182 and 182*a*, under the heading "Total Price to Customer", we find that the total sum received by the defendant corporation in its sale of infringing transformers amounts to $938,092.66, which sum excludes $15,460.00 for transformers sold by the defendant corporation to the Union Carbide Company on December 7, 1898, found at pages 183 and 183*a* of that transcript.

Also, if our addition be correct, the net price received by the defendant from the sale of infringing transformers since June 24, 1896, after deducting commissions to agents and excluding the said transformers sold to the Union Carbide Company (for transformers sold to Union Carbide Company see pages 183 and 183*a* of said transcript), is $856,881.05.

As no commissions were paid to agents in the sale of the Carbide transformers, as appears from pages 183 and 183*a* of that transcript furnished by Mr. Layman, the gross amount received by the defendant, including those Carbide transformers, was $953,552.63. and the net amount received by defendant, after deducting agents' commissions, was $872,341.05.

It is for the Master to verify our additions, and the above statement is made upon the theory that the additions have been correctly made.

In the present case complainant elects to claim only the profits made by the defendant in the sale of its infringing transformers made and sold during the six years prior to filing the bill of complaint, as set forth in the account produced by Mr. Layman. The circumstances are such that it is somewhat difficult to establish a rule for the ascertainment of these profits.

Mr. Layman, who is general manager and treasurer of the defendant corporation, and therefore in a position to know all that is known or can be ascertained from the books and records of the defendant on the subject, testifies that it is impossible for the defendant to furnish data by which the cost to the defendant company of the infringing transformers can be ascertained. It is, therefore, necessary to lay down a rule by which the probable profits on the infringing manufacture can be ascertained.

On page 64 of his testimony, Mr. Layman gives a tabulated statement covering the years 1896, 1897, 1898, 1899, 1900 and 1901, showing the total volume of the defendant's business for each of those years; the "proportion of business involved in the
502 record of this inquiry" during those years, which means the proportion of business in the way of sales of infringing transformers for that period; and the total profits of the defendant company on all kinds of apparatus during the same period. This statement shows that during those years the total volume of defendant's business amounted to $2,314,778.73; that the total volume of business in the sale of infringing transformers was $955,271.76; and that the total profits of all the defendant's business during those years, after deducting the losses of two years (1897 and 1900) amounted to $182,001.02.

Complainant, not being bound by the statements of Mr. Layman, has established by the testimony of Johannesen and Foster and the exhibits produced by them that it was the practice of the defendant during the years covered by Mr. Layman's statement, after charging everything that could be charged against the manufacture of transformers, to add 25% in making up the selling price, this 25% representing the profit of the defendant. It was also established that this general rule prevailed as to everything manufactured and

sold by the defendant corporation during the years covered by this accounting, excepting as to switch-board work, on which the percentage added for profit was 20% (Foster, p. 63, Q. 19; p. 69, Q. 38). According to Mr. Layman's statement (p. 64 of his testimony) the defendant made a general profit on its business during the six years accounted for amounting to $182,001.02, but Mr. Layman testifies that the profits on the transformers were so intermingled with profits on other articles made and sold by the defendant that it is impossible to separate the profits due to infringing transformers from the profits derived from other articles which the defendant corporation made and sold. Upon the evidence now before the Master, we are able to formulate two rules for arriving at what may reasonably be said to be, under the facts in this case, the net profits derived by the defendant from its manufacture and sale of infringing transformers.

First, taking the statement of sales of infringing transformers produced by Mr. Layman and bearing in mind that in fixing its profit on such manufacture it was the custom of the defendant to add 25% over and above everything chargeable to labor, material and expenses of the business, and that the price received by the defendant for the infringing transformers, as shown by Mr. Layman's statement, after deducting the amount paid as commissions to agents, amounted to $856,881.05, 25% of this amount is equal to $106,406.92 (see Johannesen, Q.'s 50-53). This sum excludes 25% profit on the $15,460 received by the defendant for the infringing transformers sold to the Union Carbide Co. 25% of $15,460 is $3,865.00, and this last sum added to $106,406.92 makes a total of $110,271.92, which, on the 25% profit rule, represents the defendant's profits on the infringing transformers sold by it and shown by Mr. Layman's account.

503

Second. Another rule for ascertaining the profits of the defendant is based on the statement of the volume of business and profits found at page 64 of Mr. Layman's deposition, and treated on pp. 23-25 of Johannesen's deposition, Qs. 54-55. Mr. Johannesen finds that the infringing proportion of the business for the six years covered by Layman's statement on page 64 of his deposition amounts to 41.26% of the total amount of business, and that this percentage of the total profits for the six years is $75,093.62. Complainant's testimony shows that it was the defendant's rule to add the 25% to the total cost in fixing the selling price for all apparatus manufactured and sold by the defendant, whether transformers or other machines, except switch-board work, in which case the profit was fixed at 20%. The transformer business, therefore, yielded as much, if not more, profit as any other business done by the defendant, and therefore, it is fair to rate it as entitled to an equal proportion of the total profit.

This second rule is eminently fair to the defendant, because it deals only with profits actually made by it, deducting not only the cost of manufacture, general expenses, etc., but also the loss of the two years 1897 and 1900 which Mr. Layman states, on page 64, was suffered in the business.

We submit these facts to the Master in connection with the closing of our proofs, with the statement that, under all the circumstances, complainant could reasonably claim the 25% rule as to profits, which would give us, as defendant's profits on the infringing transformers, excluding those sold to the Union Carbide Company, $106,406.92, and which would give us as defendant's profits on infringing transformers, if we include the transformers sold to Union Carbide Company, $110,271.92.

However, complainant is satisfied to claim, and does here claim, if required to make any claim at this stage, the smaller amount as given by the second rule pointed out specifically by reference to Qs. and Ans. 54 and 55 of Mr. Johannesen's testimony, pp. 23, 24 and 25 thereof, which amounts to $75,093.62. This amount of $75,093.62 we claim as profits made by the defendant and attributable to the infringement by the defendant of claim 4 of the Westinghouse patent in suit.

We merely here state our present claim, asking leave at the proper time and at the Master's convenience, should the reference
504 stop here, to present oral argument and a brief in support of the same, should the reasonable contention which we here make be disputed by the defendant. We are prepared to show at the proper time and based upon reason and authority that, under the peculiar facts in this case, we are entitled to recover from the defendant as defendant's profits, by reason of its infringement, the sum of $75,093.62 hereinbefore stated.

KERR, PAGE & COOPER,
BAKEWELL & CORNWALL,
Solicitor- for Complainant.

St. Louis, Mo., March [*March*] 24th, 1905.

ST. LOUIS, Mo., *April* 18, 1905.

Parties met pursuant to adjournment at the office of Fowler & Bryson, Commonwealth Trust Building.

Present: Mr. H. H. Denison, Special Master; Mr. Paul Bakewell, counsel for complainant; and Mr. John Fowler of counsel for defendant. Whereupon the following proceedings were had:

Mr. BAKEWELL: At the session of April 9th, at which I, as representing the complainant, could not be present, I find in the report of that session that defendant's counsel made a motion "That the Master find that the complainant has not shown any profits due to the patented invention and in view thereof defendant's counsel requests and moves the Master to find that the Complainant is entitled only to nominal or no profits; and, therefore, defendant's counsel requests and moves the Master to find that the Complainant should pay all costs in this reference."

Then, "defendant's counsel requests the privilege of filing a written brief and argument in support of the above motion, at or before the next session; with leave, of course, to complainant's counsel to reply thereto."

Then I find "Defendant's counsel makes the above motion with the understanding that he does not thereby waive his right, should the Master rule against the motion, to present testimony for the defendant in this case."

Now, as I understand it, this last statement I have read, to-wit: that "Defendant's counsel makes the above motion with the understanding that he does not waive his right, should the Master rule against the motion, to present testimony for the defendant in
505 this case," represents merely the statement of defendant's counsel. I do not understand that anything was passed upon in regard to that.

I want to raise the question of practice in a proceeding before a Master, in regard to this matter. As I have already declared at a former session, that is to say at the session of March 24th, that Complainant rested his case on the testimony as given, and on the record as presented before the Master. That is, that Complainant rests his prima facie case. Now I do not understand that it is proper practice, or that defendant has a right to make this in a shape of an alternative motion, at this stage at any rate. It amounts practically to a demurrer to complainant's evidence. And if the view taken by defendant's counsel is correct, he has an opportunity now of raising that question, whether or not we have made a prima facie case; and should the matter be decided against the defendant, then he has the privilege of taking testimony. According to my view of the practice bearing upon these matters I think the defendant should declare now, for good, whether or not he proposes to take testimony. If he does not propose to take testimony at all, I am perfectly willing to meet him on the issue on the proofs, under the particular facts in this case, and on the record as it stands. But I deny the right of defendant's counsel to play fast and loose in the matter, and take the position first, that we have not made out a prima facie case; and then, if we have not made a prima facie case, for him to take testimony. If he intends to take testimony he may raise additional issues, and it may be necessary for complainant to take rebuttal testimony, and then when all the testimony is in, if the defendant is going to take any testimony, it seems to me he is in the position to raise the point then whether or not we have made a prima facie case. In other words I do not think the course defendant's counsel is suggesting to take is a proper course to take at this stage. If he finally declares he has no testimony to take then I am ready to prepare to argue the matter before the Master and submit it on briefs.

Defendant's counsel states that he thinks his position is entirely reasonable in this matter. He has moved the Master to find that the complainant has not made out a prima facie case. But if the Master thinks that the complainant has made out a prima facie case, then all he asks is the right to meet that prima facie case. Then counsel thinks, and submits this position is entirely reasonable and in accordance with the practice.

The MASTER: My view of this matter which I expressed while we were in Pittsburg taking testimony, that the matter at
506 issue between the parties was whether the damages should be confined to Specification 4; or whether the damages should

be confined to the use of the entire machine; and it seemed to me that that was the issue between you gentlemen.

Now, at the conclusion of the complainant's case the motion which was filed at the last hearing was presented by counsel for defendant, and whatever may have been the informality of the method of procedure, it was virtually a demurrer to the evidence. A demurrer to the evidence by all analogy, it seems to me, can be entertained at this stage of the proceedings as well as if it were before the open court. And although the question which would be raised by the demurrer to the evidence might be the same question which would be ultimately raised after all the testimony of both parties was in, I do not think that makes any difference with regard to the right of the defendant to demur to the evidence. When the Master passes upon the question of whether the demurrer is rightfully presented, or whether the demurrer should or should not be sustained, if the latter it follows as a matter of course, in my judgment, that the defendant would be entitled to proceed with his testimony and present the issues at the end of the hearing. I do not think that the mere fact that the motion is made in the form in which it has been presented before the Master takes away from it the fact that it is virtually a demurrer to the evidence, and being overruled it follows as a matter of course that the defendant must proceed and make out his case. I do not think the Master has—I doubt if he has—the power, and I do not think it would be wise in him to take the position that if the defendant presents and argues this motion he is consequently debarred from introducing testimony in case the motion should be overruled.

Counsel for Complainant excepts to the ruling of the Master.

Counsel for defendant states that owing to interruptions and pressure of other business he has not had an opportunity to prepare a written argument in support of the motion made and requests until the end of this work to file such argument, with leave to [*to*] Complainant's counsel, of course, to file argument against the motion.

It is ordered by the Master that defendant's counsel have one week from to-day in which to prepare and submit that brief; and that complainant's counsel have two weeks thereafter in which to reply to the same.

Thereupon the further hearing herein was adjourned by the Master to Tuesday, May 9th, 1905 at 10:30 a. m.

507 St. Louis, Mo., [——] *9th*, 1905.

Met pursuant to adjournment as above, at the office of Messrs. Fowler & Bryson in the Commonwealth Trust Building, on Tuesday, May 9th, 1905.

Present: Mr. H. H. Denison, Special Master; Mr. Paul Bakewell, of counsel for Complainant and Mr. Albert C. Fowler of Counsel for Defendant; when the following proceedings were had:

Counsel for Defendant files with the Master a Brief and argument for defendant, on defendant's demurrer to the evidence before the Master. Service of copy of which Brief and argument was made

upon complainant's counsel on the 25th of April, 1905, and is acknowledged as of that date.

Counsel for Complainant now hands to the Master a copy of complainant's Brief in answer to the Brief of the defendant, which Brief of the defendant is referred to in the preceding statement made by defendant's counsel. Counsel for Complainant also gives to defendant's counsel a carbon copy of the identical Brief handed to the Master.

The MASTER: The Master takes the defendant's demurrer to complainant's evidence, under consideration, with the Briefs submitted.

At this point an adjournment was taken to Friday, June 2, 1905, at 10:30 a. m.

ST. LOUIS, *June* 2, 1905.

Parties met pursuant to adjournment, at the offices of Messrs. Fowler & Bryson, in the Commonwealth Trust Building, St. Louis, Missouri.

Present: Mr. H. H. Denison, Special Master; Mr. Paul Bakewell, counsel for complainant; and Mr. Albert C. Fowler, counsel for defendant.

Whereupon the following proceedings were had:

With consent of counsel for complainant and defendant, the Master adjourned the further hearing herein to Tuesday, June 6, 1905, at the hour of half past ten o'clock a. m.

ST. LOUIS, *June* 6, 1905.

Parties met pursuant to adjournment as above, on Tuesday, June 6, 1905, at half past ten o'clock a. m., at the offices of Messrs. Fowler & Bryson, in the Commonwealth Trust Building, St. Louis, Mo.

508 Present: Mr. Paul Bakewell, counsel for complainant and Mr. Albert C. Fowler counsel for defendant; and Mr. H. H. Denison, Special Master.

The following proceedings were had:

The MASTER: This matter comes up this morning upon motion of defendant's counsel to find that upon the prima facie case as made by the complainant, the complainant is entitled to recover only nominal damages.

That is, I suppose, upon the theory that the complainant has not in his testimony distinguished between damages which would be properly attributable to Claim Four and those damages which he appears to claim upon the complete converter, which embraces Claim Four.

Counsel for defendant in his brief which he furnished me, has made one point which I think perhaps it would be as well to mention and dispose of first: and that is, that it appears that the great majority of all transformers which are included in the tabulation in Mr. Layman's testimony, are converters which are of a size which the General Electric Company makes without using Claim Four. Am I correct in that, Mr. Fowler?

Mr. FOWLER: Yes, sir.

The MASTER: Upon that point, it seems to me, that the owner of the patent may lock it up in his safety vault and make no use of it at all; but the fact that he does so does not seem to me to give any right to an infringer; that is, in my view, the patent which is withdrawn from public use and not marketed by the owner and holder, is, nevertheless, a property which is protected from infringement. And the difference would be that in case it were not marketed, the infringer would account for the profits earned by the infringement; but he could not be held for damages resulting from competition and loss of trade, for the simple reason that the owner was not manufacturing the patent, nor seeking trade for it. It seems to me wholly immaterial that neither the complainant nor the General Electric Company, its licensee, is using this Claim Four; and it seems to me also immaterial that the most if not all the transformers testified to by Mr. Layman are the sizes in which the General Electric Company does not use Claim Four.

On that view which I hold (and I have not found any rule to the contrary) I am inclined to think that notwithstanding the complainant or the General Electric Company may manu-
509 facture transformers without using Claim Four, nevertheless an infringer using Claim Four must account for the profits resulting from such use.

Now in regard to the general question, I find that upon the pleadings the defendant admits that it is bound by the opinion of the court in the case against the Union Carbide Company. In looking at that case it seems to me that in treating of this matter counsel has departed somewhat from Claim Four as stated.

The Carbide Company case says: "Said claim is as follows:

'Four. The combination, substantially as described, of an electric converter constructed with open spaces in its core, an inclosing space, and a non-conducting fluid or gas in said case adapted to circulate through said spaces and about the converter.'"

The opinion then proceeds to itemize something about the claims of complainant and defendant in that case, and then goes on to say:

"Westinghouse, then, was the first to patent such an air-tight, closed converter. Does the combination covered by the claim in suit show patentable invention?

If the idea of ventilation be rejected, and the patent be confined to the statement of and claim for the enclosed construction, it embodies at least a combination radically modified from those of the prior art in order to adapt it to a novel purpose." * * *

"In these circumstances, the patentee seems to be entitled to claim the means by which the external and internal surfaces of the heat reducing parts of a converter were cooled by such an arrangement and separation of parts as would permit the circulation about them of oil, and the means for the retention of said oil within and about said surfaces, whereby the heat from the oil radiated to the surrounding air. If there is any doubt upon the question of patentability, the practical and commercial results of this improvement must resolve such doubt in its favor.

"It appears that in the early history of the art only small converters were used and the heat generated in them was dissipated by radiation into the surrounding air. But when the art began to call for converters exceeding ten kilowatts in capacity it was found, as stated by the expert for complainant, 'that the capacity of the transformer increased as the cube of the linear dimensions,
510 and the heat, if the amount of loss was held stationary, would increase in like proportion, while the radiating surface would increase only as the square of the linear dimensions.'

"Further difficulties were encountered resulting from the inequality of the conductivity of iron and copper. The testimony herein shows that these difficulties were so serious that for some time it was feared that the practical limit of such transformers had been reached; that experiments were made by grouping, by the use of lower currents densities, by filling the cases with oil, and by subdividing the iron and copper parts of the converters by large ducts and using forced drafts. It was only when, as the result of these experiments, it was found that the oil would circulate through the ducts that any practical progress was made. Then, as Complainant's expert says:

'The problem of making large units became greatly simplified. It became only *only* necessary to so subdivide the coils and iron so as to expose a uniform surface as compared with the losses in the transformer in all sizes, and to provide a case having sufficient external surface to enable the oil again to give up its heat to the surrounding air, to make transformers of any desired capacity.'

"The practical result of the invention in suit, as testified to by complainant's experts, was to so increase the capacity of converters that while a dry converter cooled by the natural circulation of air is limited to ten kilowatts, the oil insulated converters of the patent in suit are commercially serviceable up to five hundred kilowatts."

I have quoted from the Opinion of the Court of Appeals, by Judge Townsend, in the Carbide Company case, which would lead me to the conclusion that while I am not prepared to say that the ultimate finding of the Master will permit the Complainant to recover for the use of the entire transformer, including Claim Four, nevertheless, I am not prepared to say that he will necessarily be limited to Claim Four; and that for the reason that there has been no distinguishment in the testimony heretofore, showing the amount of damages due to Claim Four alone; and the amount of damages claimed for the entire converter; so that it would not be proper for me to take such action now as would conclude the complainant and compel a finding for nominal damages upon the present presentation of the case.

I am obliged, therefore, to rule that the motion of the defendant that the Master render judgment upon the prima facie case as made out by the complainant, for nominal damages, is overruled.

511 Mr. Fowler: Does your Honor rule that the complainant has made out a prima facie case showing that it is entitled to the Seventy-five odd thousand Dollars' profit, as claimed by the

complainant, and due to the patented invention as covered by Claim Four of the patent in suit?

The MASTER: It seems to me that the Complainant has made out a prima facie case, his testimony having been directed in the main to the right to recover for profits made upon the entire converter. The motion as made by the defendant, that the Master should rule that the complainant was entitled to only nominal damages on the prima facie case, it seems to me goes too far in asking the Master to separate the damages which the complainant would be entitled to recover for the entire converter from the damages which he would be entitled to recover under Claim Four, when neither the defendant nor the complainant have either of them produced any evidence to show to the Master that the damages should be confined to Claim Four, and showing what, if anything, those damages should be, as distinguished from the damages which would result from the infringement growing out of the manufacture of the entire converter.

It seems to me, in the present aspect of the case, that it is the province of the defendant now, if he is able to do so, to show that whatever profits have resulted from the use of the converter, as shown in the testimony heretofore, should be confined to nominal damages as resulting from the use of Claim Four alone, as distinguished from the entire converter, provided any damages can be shown to have resulted from the use of Claim Four alone. In other words, I do not think the testimony in the case is in such shape that the Master can properly distinguish between the damages as attempted to be shown for the use of the entire converter, and the damages which have not been shown at all, for the use of Claim Four alone, distinguished from the entire converter.

Mr. FOWLER: Does you Honor rule that the complainant has shown profits due to Claim Four of the Patent in suit?

The MASTER: I have just indicated that in the present condition of the testimony, it is impossible for me to distinguish between the damages which have resulted or have been shown as resulting from the use of the entire converter, and damages for the use of Claim Four alone. There is no testimony before me, up to this time, which will enable me to draw any conclusions upon that
512 point. There has been no testimony before me showing what the damages might be for the use of Claim Four alone. That is to say, what have been the profits earned by the defendant from the use of Claim Four, as segregated from the entire converter.

Mr. FOWLER: Does your Honor rule that the Seventy-five thousand odd Dollars' profits claimed by the complainant are the profits on the entire converter?

The MASTER: I think my previous statement covers that quite completely. The only testimony before me with regard to profits derived from the infringement relates to profits resulting form the manufacture of the entire converter, embracing within its construction Claim Four.

Mr. FOWLER: Does your Honor then rule that the Complainant has not shown what part, or any part, of the Seventy-five Thousand

odd dollars' profits claimed by it is due to the patented invention, to-wit to Claim Four of the patent in suit?

The MASTER: I have tried to make it clear that the testimony so far as it has been produced before me, goes to establish the claim of profits resulting from the manufacture of the entire converter, which embraces within its construction Claim 4; that there has been no separation, in the testimony, of the amount of the profits which would result exclusively and solely from the use of Claim Four I have also tried to make clear. The Complainant, so far as the case has proceeded before me, is claiming the recovery of profits which have resulted from the manufacture of the entire converter, and for the reason that the manufacture of those converters include within their construction Claim Four, which the Court has heretofore held has been infringed by the defendant. Now until testimony is produced before me, showing that the profits which have resulted from the use of Claim Four are other and different from the profits which the complainant claims to be entitled to recover for the manufacture and use of the entire converter, which embraces Claim Four, it seems to me I am not at liberty to find that the complainant is entitled to recover only nominal damages, from the simple fact that he has not made that distinction in the testimony.

Counsel for defendant notes an exception to the Master's ruling, and requests the Master to file the testimony in court and certify the proceedings to the court, in order that the defendant may have the court rule upon the exception.

By consent of counsel, the Master here adjourned the proceedings to Tuesday, June 13, 1905 at 10:30 a. m.

513 ST. LOUIS, *June* 13, 1905.

Met pursuant to adjournment as above, on Tuesday, June 13, 1905, at half past ten o'clock a. m., at the offices of Messrs. Fowler & Bryson, Commonwealth Trust Building, St. Louis, Missouri.

Present: Mr. Paul Bakewell, Solicitor for Complainant; Mr. Albert C. Fowler, Solicitor for defendant; Mr. Henry H. Denison, Master; when the following proceedings were had:

Mr. Paul Bakewell, solicitor and counsel for complainant, begs leave to suggest that the record of the meeting of June 6, 1905, be amended to show that Mr. Bakewell was unavoidably absent on that occasion, having been represented then merely by a clerk from his office, Mr. Ralph Kalish. By mistake it would appear from the record that Mr. Bakewell was present at the last meeting.

Mr. Bakewell, solicitor and counsel for complainant, referring to the record of proceedings of June 6, 1905, observes that the counsel for defendant, at the meeting of June 6, 1905, noted an exception to the master's ruling, and requested the Master to file the testimony taken before the Master in court, and certify the proceedings to the court, in order that the defendant may have the court

rule upon the exception taken by the defendant's counsel to the ruling of the Master on June 6, 1905.

Counsel for complainant respectfully submits that the course suggested by the defendant's counsel as stated above, is not in accordance with the proper practice, and should not be taken. Under the interlocutory decree filed in this case, the matter of this accounting was referred to the Master, as appears from said interlocutory decree, and for the purposes stated therein. As counsel for complainant understands the situation, on June 6, 1905, the Master did not make a final report, but simply then and there overruled the demurrer interposed by defendant's counsel to complainant's proofs in chief, before the Master.

At this stage, counsel for complainant respectfully submits, there is nothing to certify to the court, unless the counsel for defendant declares here and now that he does not propose to take any proofs on behalf of defendant before the Master, in which case it would be for the Master to make his final report; which it would be for him to make in accordance with the practice that prevails in equity in the United States Circuit Court; and that until such final
514 report is made by the Master, there is nothing, properly speaking, and under the practice which prevails, for the Master to certify to the court.

Counsel for defendant states, that he is not willing to declare at this time that he does not intend to take any evidence on behalf of the defendant. That it has been held in a number of cases that under extreme circumstances exception made to a Master's report may be submitted to the court, and that he thinks this exception is of such nature; the Master, as counsel for defendant understands it, having ruled that complainant has not shown profits due to Claim Four of the patent in suit, and that being the only claim involved in this case, he does not think that he is called upon to take any evidence in this case, and intends to make a motion to bring this matter before the court.

Counsel for complainant in the first place calls the attention of the Master, and the Court, to the fact that the Master has not yet made his final report; that there has been as yet no "coming in" of the Master's report, (to use the technical phrase). The record simply shows that after complainant's proofs in chief before the Master on this accounting were closed, the defendant interposed a demurrer to the complainant's evidence, which demurrer the Master has overruled. On well settled principles of practice, as there has as yet been no final report from the Master, it is improper and contrary to well settled practice to take this question ruled upon by the Master at the session of June 6, 1905, to the court at this stage, and before the coming in of the final report of the Master. Counsel for defendant will except to the Master's ruling, but the reference must now proceed before the Master, or the defendant's counsel must declare that he refuses to take further testimony, in which case it will be for the Master to make his report, as a final report, and file the same in court, after which it will be for the party who may think that the Master has erred to except to the Master's report, and present

the same to the court. This is not only in accordance with well settled practice, but has been repeatedly ruled upon by the court in analagous cases, that the matter of a reference to a Master, who is in fact a branch of the court, or the court itself, for the purposes of this accounting, shall not be interrupted before the coming in of the Master's final report, and in the manner suggested by defendant's counsel. And complainant's counsel is ready here and now to present to the Master, if the Master should so desire, authorities which sustain his contention as to the course which should now be taken.

515 The Master states, in reply to the motion of the counsel for defendant that the Master should transmit his record to the court and ask for instructions, that it is purely a question of practice, and while he has his own view in regard to that matter, unaided by any authorities which may bear upon the same question, he would prefer to have counsel on both sides furnish him with such authorities as they can upon this question of practice, as a rule of action for the Master to be guided by; and to give counsel an opportunity to furnish such authorities, the Master will adjourn this hearing to such date as counsel may agree upon.

Counsel for defendant states that in the way the Master has stated the matter, it does not appear that it was my intention to have the matter certified to the court, and have the court rule upon the exception. From the way it is put, it would appear that counsel for defendant had requested the matter be referred to the court for instructions. It may mean the same thing, only differently expressed.

Counsel for complainant states, that as he understands the position of defendant's counsel now, either as he may have stated it on the record, or off the record, in discussing this matter, while a moment ago we were discussing the question of submitting to the Master briefs and authorities as to whether or not it was the duty of the Master, at this stage, to certify the record of proceedings to the court, for the purpose of having the court determine whether or not the Master was right in overruling defendant's demurrer to the complainant's proofs in chief, on the accounting; now I understand the defendant's counsel to state that he proposes to take this question to the court, by motion. I am either laboring under an entire hallucination, or that is what I now understand the defendant's counsel to state. That being clear, I am curious to know of what avail it may be to submit to the Master authorities on the question of whether or not it is the duty of the Master now to comply with the request made by defendant's counsel, at the foot of the record of the meeting on June 6, 1905. It seems to me that the attitude of defendant's counsel, although no doubt unintentional, is not only not proper practice, but also not proper respect for the authority of the Master in this case. It seems to me if we are going to have an adjournment now, we ought to know definitely the purpose of this adjournment. Whether a question of practice is to be submitted to the Master to be determined by him; or, whether the adjournment is for

516 the purpose of enabling defendant's counsel to prepare and formulate a motion to be made in court, which motion, as complainant's counsel understands, will be in the nature of a motion

calling for a rule on the Master to comply with the request made by the defendant's counsel at the foot of the record of the meeting of June 6, 1905.

The MASTER: It seems to me that the value of having the authorities furnished to the Master, so he might act in accordance with the rulings which have been made in similar instances by the United States court, would be that possibly the Master might come to a conclusion that it was either within his power, or was his duty, to comply with the request of counsel and file his record in court, in order that the court might pass upon the question of whether the Master had committed error, in which event it would not be necessary for counsel for defendant to go into court and by motion ask the Master be compelled to produce his record, and be guided by the action of the court at this state of the hearing. So it seems to me that, irrespective of the fact that counsel for defendant has stated he expects to proceed by motion, it would be well for counsel on both sides to submit the authorities which they say they can do, in order that the Master may take such action as he can, with such guidance, and with as little error as possible. But, after all, when you get back to the main question, it seems to me that whether the matter goes into court upon the voluntary action of the Master, in compliance with the motion of the defendant's counsel before him, or whether the Master goes into court upon the mandate of the court, upon motion of defendant's counsel before the court, that it would be necessary in either case for counsel for defendant to proceed by motion before the court, no matter how the record gets there. It is a matter which cannot be brought before the court, and which the court cannot be asked or expected to take action upon, without motion.

Counsel for defendant states, that he never has had any intention of proceeding in this matter except by motion in court, and his request at page 173 [*or*] the type-written record was that the Master file the testimony in court, and certify the proceedings to the court, "In order that the defendant may have the court rule upon the exception." This was not with any understanding that it was to be done in order that the Master might have the court rule upon the exception. He merely asks the Master to file the testimony and certify the proceedings in court, in order that he may base a motion upon the testimony and proceedings, as certified.

517 Counsel for complainant understands the question yet to be determined by the Master, and which remains open until the Master has ruled upon the same, is whether or not the Master is obliged, under the rules which prevail in equity practice in the United States courts, to comply with the request made by the defendant's counsel, which he has above referred to, which [*which*] is stated at page 173 of the type-written record.

Counsel for defendant now further states, with reference to the Master's ruling at the top of typewritten page 167, that he has never contended in this case that because the General Electric Company manufactures transformers without using Claim Four, that the defendant did not have to account for the profits resulting from such use. His only contention along that line was, to show that the invention of Claim Four of the patent in suit was not controlling

and not indispensable in the transformer, and that, therefore, the complainant was not entitled to the entire profits on the transformer.

Counsel for complainant submits that he does not understand that this is to be a re-argument of the question submitted to the Master. As a matter of fact there was no oral argument of the question submitted by defendant's demurrer to complainant's proofs, and that the entire matter was submitted on briefs of counsel; and, furthermore, the question as now raised by the defendant's counsel as representing his contention before the Master, which he claims the Master misunderstood, is an utterly immaterial question. Counsel for complainant does not admit that the record shows that the General Electric Company, which is not the complainant in this suit, has not used the invention of the patent in suit, and counsel for complainant submits it is entirely apart from any issue before the Master whether or not the General Electric Company used the invention, the subject matter of Claim Four in the patent in suit (the only claim involved in this case). The value of the invention, the subject matter of Claim Four of the patent in suit, has been determined by the Circuit Court and the Circuit Court of Appeals of the United States, in the Carbide Company case, and it was distinctly admitted by the defendant's answer in this case that the findings of the court in the Carbide case are binding upon this defendant. These findings establish the value of the invention, the subject matter of Claim Four of the patent in suit. It further appears from the testimony adduced before the Master, in this case, that the defendant has made and sold on a large scale, running up to thou-
518 sands of transformers, transformers which embodied in their construction as an entirety the invention, the subject matter of Claim Four of the patent in suit. Therefore, the question which defendant's counsel now seeks to have light upon from the Master is, as viewed by complainant's counsel, utterly irrelevant and immaterial.

Defendant's counsel states that he has not asked any light from the Master on this question, and merely wishes to put himself right on the record.

Defendant's counsel states that several days ago he was furnished with the typewritten copy of the Master's rulings on defendant's demurrer to the evidence. He has carefully read those rulings, and it is not clear in his mind as to whether the Master has ruled that complainant has shown that it is entitled to the entire profits on the transformer. Defendant's counsel therefore asks the Master whether he has ruled that complainant has shown that it is entitled to the entire profits on the transformer, or asks that the Master will now rule on that question.

Complainant's counsel objects to this method of procedure, stating that it is uncalled for and, after all, is simply in the nature of a fishing expedition on the part of defendant's counsel, for the purpose of determining, possibly, in his own mind, what course he should pursue, when it is for the defendant's counsel, with the knowledge of the facts and the law applicable thereto, to determine without guidance from the Master as to what course the defendant should pursue. At the close of complainant's proofs in chief, or

shortly thereafter, the defendant, by its counsel, demurred to the evidence in chief before the Master on this accounting, on the ground that the defendant had not made a prima facie case, and that, therefore, the Master should find that the complainant is entitled to only nominal damages. Complainant's counsel understands that the Master has overruled that motion. It is for the Master to render an opinion in overruling that motion or not, as he saw fit. The Master has seen fit to express himself on the record, at the session of June 6, 1905, in respect to his conclusions, and he was then and there interrogated by defendant's counsel, and answered those interrogatories. Complainant's counsel respectfully submits that it is unseemly and not in accordance with proper practice, for the Master to be now interrogated with a view of determining what may or may not be in the Master's mind, thus acting as a guide and assistance to defendant's counsel in the course which he may see fit to take in this case. For these reasons the counsel for complainant ob-
519 jects to the interrogatory propounded by defendant's counsel to the Master.

The MASTER: At the hearing on June 6, 1905, I set forth my reasons primarily and in answer to interrogatories of counsel for defendant, quite fully, and perhaps more at length than was necessary in simply overruling the motion. But I think it is unnecessary for the Master to add anything to what he said at that hearing, which appears upon pages 170, 171, 172 and 173 of the typewritten record. It seems to me that everything suggested by counsel for defendant in his present request is completely covered by what the Master stated at that time.

At this point the further hearing herein is adjourned to Tuesday, June 27, 1905, at half past ten o'clock a. m.

ST. LOUIS, *June* 27, 1905.

Met pursuant to adjournment as above, on Tuesday, June 27, 1905, at the offices of Fowler & Bryson, in the Commonwealth Trust Building, St. Louis, Missouri, at eleven o'clock a. m.

Present—Mr. H. H. Denison Special Master; Mr. Ralph Kalish, representing counsel for complainant; Mr. Albert H. Fowler, counsel for defendant; when the following proceedings were had:

The MASTER: The request of counsel for defendant upon the Master to file his record in court, for the purpose of having the court pass upon the propriety of the Master's ruling in overruling the motion for judgment, is overruled; for the reason that it appears to the Master that it would be an impropriety on his part to proceed to take such action voluntarily, even at the request of counsel.

Counsel for defendant excepts to the ruling of the Master.

At this point the further hearing of proceedings adjourned to Friday, July 7, 1905, at half past ten o'clock a. m.

Testimony for the Defendant.

ST. LOUIS, Mo., *July* 7, 1905.

Met pursuant to adjournment as above, at the office of Messrs. Fowler & Bryson, in the Commonwealth Trust Building, St. Louis, Missouri, on July 7, 1905 when by consent of parties adjournment was made to a date to be agreed upon later.

520 ST. LOUIS, Mo., *October* 25, 1905.

Met pursuant to adjournment as above, at the office of Messrs. Fowler & Bryson, in the Commonwealth Trust Building, St. Louis, Missouri, on Wednesday, October 25, 1905, at half past ten o'clock a. m.

Present—Mr. H. H. Denison, Special Master; Mr. Paul Bakewell, appearing in behalf of the complainant; and Mr. A. C. Fowler, appearing in behalf of the defendant; when the following proceedings were had:

FRANCIS E. NIPHER, a witness of lawful age, being duly produced, sworn and examined on behalf of the defendant, testified as follows:

Direct examination.

By Mr. A. C. FOWLER:

Q. 136. Are you the Francis E. Nipher who previously testified in this case, for the defendant?

A. I am.

Q. 137. Did you, in your previous testimony, testify concerning the patent in suit, and particularly the subject matter of claim four thereof?

A. I did.

Q. 138. Having regard now to the patent in suit, and particularly claim four thereof, will you please state what, if any, advantage there is in a transformer possessing the characteristics set forth in said claim, and whether such construction is essential to or indispensable in a transformer? Please give your reasons for your answer, and any authority which you may have for the same?

Mr. BAKEWELL: That is objected to. We are not taking testimony here for final hearing. We have gotten away beyond that point. We are taking testimony on an accounting as to the profits, and purely on the question of profits, made by the defendant in respect to a particular form of transformer which the court by its decree has declared to be a new and useful invention and one which has been infringed by the defendant. I respectfully submit that this inquiry here cannot throw the slightest light upon the particular question which is before the Master, nor does it in any way tend to affect or rebut the testimony taken in chief in this case, on this accounting. It is not now a question of the construction of this claim. It is not for this expert to say whether or not in his

opinion the identical thing called for by the claim of this patent, declared to have been infringed, is or is not useful. All the authorities are to the effect that where a defendant has used the subject matter of the claim of the patent, and the court has so declared, it is not for him to say whether or not it is useful; he is estopped from that. We are going into a lot of side issues here, which
521 have nothing to do with the accounting.

Mr. FOWLER: The question does not ask for any opinion of the witness on the question of infringement, and we submit we have a right to show here that this invention does not accomplish what the witnesses for the complainant have testified to in their case in chief before the Master. The testimony has been to the effect that without this spacing of the iron, the iron will age very materially, and cause a deterioration of the transformer. We propose to meet that evidence, and this question is predicated on that issue.

Mr. BAKEWELL: Your honor will remember perfectly well that the question as to aging, etc. were all brought out by the other side in cross-examination of our witnesses at Pittsburgh.

Mr. FOWLER: See Re-D. Q. 106 and 107 of the testimony of Mr. Johannesen: Here we have brought out by the complainant that it is a distinct advantage to have these spacing strips in the core and these spaces in the core, for the purpose of keeping the core cool and for the purpose of preventing, as they say, the aging of the iron. And when we endeavor to show that this invention cannot accomplish these things, and has not this advantage, then complainant objects.

Mr. BAKEWELL: That came out in matters that Mr. Fowler went into on direct examination, subject to my objection. What does it bear upon? Look at the very question and answer to which he refers, that the defendant recognized and represented that there was [n-] advantage. That is the only point, and that came out on re-direct examination, due to matters which Mr. Fowler had gone into on cross-examination. How can that be affected by questions which may be asked this witness as an expert? The question is, whether the defendant recognized whether or not there was an advantage in using that claim, which the court declared they did use. It is arguing in a circle. Can a defendant, on an accounting, go into the question of utility or non-utility of an invention which the court by its decree has declared is both new and useful, and has declared that the defendant has used? But this question is even stronger than that: It is unnecessary to refer to the record in this case to show that so far as claim 2 was concerned it was admitted by the Answer of defendant in this particular case that they had infringed claim 2 and that the patent was valid so far as claim 4 was concerned, and that so far as claim 4 was concerned that matter had been tried in a case in which this defendant had its day in court, and was res adjudicata. We have gone, in our proof in chief, as your Honor will remember, into the extent of the infringement by this defendant; that is, as to the number
522 of transformers comprising claim 4 of this patent that the defendant had made and sold; and we went into other testi-

mony in view of the attitude Mr. Layman had taken in the matter, to prove that Mr. Layman had not given us the benefit of that full and free disclosure to which we were entitled from him in the matter of searching his conscience before your Honor in this accounting. Now they are trying to bring a lot of fog and mystery into this case, by taking expert testimony, for the purpose of bringing in an issue which, if it were proper to raise, should have been raised by the Answer in this case, to-wit: Whether there is utility or advantage in the use of claim 4.

The question of utility is a distinct defense, which must be raised by the pleadings. They have raised no defense of that kind in the pleadings in this case; on the contrary, they have admitted it. The whole question before your honor on this accounting is the number of transformers made and sold by the defendant, embodying claim 4 of the patent in suit, and what profits they made by it.

Mr. FOWLER: It is not a question of what the defendant recognizes. The patent in suit deals with this question of the advantage of cooling the core by these spaces in the core. Now we submit that if this thing has little or no advantage, then the complainant can recover little profit. It seems to us that we are entitled to show that the entire profit on these transformers is not due to the patented invention, and this testimony is directed to that point. We submit it is a proper question.

The MASTER: The question may be answered, subject to the objection; and I will state briefly my reasons for so ruling: The court has found that the defendant has infringed claim 4 of the patent. The claim of the complainant, as I have several times had occasion to remark, is that the damages to be recovered is for the profits on the use of the patent as an entirety. The defendant, on the contrary, claims that the only damages that can be recovered are the profits for using claim 4 as segregated from the patent as an entirety. I think that upon that theory of the defendant's statement of his case and his defense, that he is entitled to show, if he can, that the recovery is only for infringement of claim 4, and that the infringement of claim 4 was for but a very trifling damage, because it resulted in but very trifling profits. If I have the things straight in my mind, that is about the distinction between the position of complainant and defendant in this case. With a view of allowing the defendant to make out, as well as he can, his defense for this infringement, from his standpoint of claim 4 of the
523 patent, I think it is proper to allow this testimony to be taken.

Counsel for complainant excepts to the ruling.

Mr. BAKEWELL: I wish to say in regard to the Master's position, that I did not understand that the defendant's contention is that because claim 4 is to be segregated we are entitled only to profits on claim 4. Claim 4 stands by itself. We sued under claim 4 and got a decree on claim 4.

The MASTER: I am undertaking only to state what I have gathered from the defendant's statements, is the intention of his

testimony and is the position which he takes. Of course I may be wrong in my conception of what his view is, and what his defense is to be; but I do not think that the Master will be misled by reason of this testimony having been introduced.

Mr. FOWLER: You have stated my position.

A. The feature in this claim which constitutes what the inventor claims an advantage, a new invention, consists in putting spacing blocks or open spaces in the iron core. The question, as I understand it, is whether such spaces in the iron core are essential or indispensable, and to what extent that may be an advantage. Every machine that is built may be improved in some particulars, and such improvements would be a disadvantage in other directions. In other words, every machine that is made, is necessarily a compromise between advantages and disadvantages. I do not regard the existence of open spaces in the core as being at all indispensable or at all necessary. Transformers operating successfully have been made, which do not have such open spaces in the core, and they are still made without such spaces. There is a distinct advantage in having the iron core warm, so long as the copper coils are cool. This diminishes the iron loss and the cooling of the copper coils diminishes the copper loss.

I would call attention to two patents obtained by men of recognized standing——

Mr. BAKEWELL: I respectfully submit the witness cannot go outside of the patent in this [controversy].

The MASTER: I think that is clearly outside the question.

A. (continued.) It is well known that running the iron core of a transformer at a comparatively high temperature diminishes
524 the iron core loss, and in this respect there is a distinct advantage in not having the iron core cooled too much. It is found to be impossible to obtain steel which will behave in the manner which is most desired—that is to say, it is not of uniform character in regard to its aging, and the makers do not know how to produce steel of uniform character. It differs, in spite of all that can be done.

The MASTER:

Q. You mean that two sheets of steel, of exactly the same manufacture and cut, or the same sheet, may age differently while side by side in the same machine?

A. Yes, sir, and used in the same way. Of course they can produce steel which is called "non-aging;" that means that most of it will age slowly. But it is also possible to use no spaces in the iron core. It has always been possible to design transformers without spaces in the iron core, which will not age, because they will not overheat, when made of proper design. For this reason I am decidedly of the opinion that such spaces in the iron core of a transformer are not of any essential importance. They may be used, and a transformer may be designed with reference to their use; but a transformer may also be designed with reference to their non-use, and

such transformer will be as successful as the other; and this was so at the time of the filing of the patent in suit.

Mr. BAKEWELL: You mean before the filing of the application for patent?

A. Yes, before the application.

Mr. BAKEWELL: I want to make an objection on the record, in view of the answer of the witness, to show to your Honor on the record in this case what such an inquiry at this stage of this case must lead to.

It is distinctly admitted by the Answer in this case which was before the court in making its decree—I refer particularly to paragraph 6 of the defendant's Answer in this case—that the case known as "The Carbide Case," which was reported in the 112 Federal Reporter, 117, and the 117 Federal Report 495 (I here refer to the decision of the Circuit Court and the Circuit Court of Appeals) was a case defended by this very defendant; that this defendant is bound by the findings—to use the exact language—"that the matters and things found and decreed in said suit against the Union Carbide Company are res adjudicata as against this defendant."

Now it is only necessary to refer to the decision of the Circuit Court in the 112 Federal Reporter 117; and the decision of the Circuit Court of Appeals in the 117 Federal Reporter 495,
525 for your Honor to see that the Circuit Court and the Circuit Court of Appeals found, that this invention, this combination, the subject matter of claim 4 of the Westinghouse patent in suit, was a new and useful invention. And it goes into that question at length, both in the decision of the Circuit Court and that of the Circuit Court of Appeals.

Now, in view of the admissions contained in this record, and in view of the decree of this court in this particular case, finding this invention new and useful, is your Honor going to permit this witness, at this stage of the case, to minimize or in any way contradict the findings of the Circuit Court and the Circuit Court of Appeals in the Carbide case, by undertaking to show that there is no advantage, or practically no advantage, in the combination which is the subject matter of claim 4 of this patent? Why, may it please your Honor, if that thing were permitted to go on, I don't know what they cannot get into this record. It seems to me the thing is plain, and answers itself. If it were true—and I do not admit it is true—but for the sake of argument for the moment let us admit that everything the witness has just said is true, does not the principle of estoppel come in and prevent them from being heard to say so, at this stage of the case? They have confessedly used this invention, the subject matter of claim 4, to the extent of hundreds, or I believe it is thousands (although my memory is not perfect in regard to that testimony), of transformers, thus confessing the utility and novelty of that invention. They have confessed so by their Answer, and two courts have found that to be the case—I may say three courts, for this court found it is by its decree. Now, is this witness to be permitted to state matters which are diametrically opposed to the findings of the court?

I should like this objection to stand to any question that may be put to this witness in regard to this matter.

The MASTER: I recognize the fact that in the Carbide case, and in the case at bar, the courts have found that claim 4 is a new and useful invention, and that the complainant in this case is the owner of it, I suppose, and that such facts are admitted in the pleadings in this case. But it seems to me that the defense is at liberty, if it can, to show that although this invention may be and may have been declared by the decree, to be new and useful, that the profit which has resulted from the use of claim 4, if it can be segregated from the entire transformer, is less or more than the amount which the complainant is endeavoring to establish it to be. It seems to me there is no incongruity or impropriety in admitting the
526 testimony for that purpose. I do not understand that this witness will be heard for a moment to undertake, by his opinion, to reverse the decrees of the court, either in this case or in the Carbide case. But in mitigation of damages, if it can be done, I think the defendant is entitled to show what he can with regard to what profits have been earned by the use of claim 4, by segregating it from the entire transformer. That is my idea of the position defendant takes, and if I am wrong Mr. Fowler can correct me.

Mr. FOWLER: That is correct.

The MASTER: With that distinction in view, I think the defendant is entitled to show, if he can, in mitigation of damages, what have been the profits which resulted from the use of claim 4, on the assumption that it is segregated.

Mr. FOWLER: If your Honor pleases, our position is, that we are entitled to show, not that this is not a new and useful invention——

The MASTER: That you would not be heard to say.

Mr. FOWLER: But we are here trying to show the extent of the usefulness of this invention.

The MASTER: Let me interrupt you. You can only show the extent of the usefulness in regard to this particular class of infringement, and the particular infringement which is charged in this bill, and upon which the court has ordered the accounting.

Mr. FOWLER: Yes. And our purpose is to show that this invention is not indispensible to a transformer, and that, therefore, not being indispensible, the complainant is not entitled to the entire profit made on the transformer, in accordance with the line of cases of the Supreme Court to that effect.

The MASTER: Of course, that is argumentative, to a very large extent.

Counsel for complainant excepts to the ruling of the Master.

Q. 139. Please refer to patent granted to Elihu Thomson assignor to the General Electric Company, No. 516,850, and patented March 20, 1894; and to patent granted to Walter S. Moody of Lynn, Massachusetts, assignor to the General Electric Company, No. 539,876, patented May 28, 1895, and state whether you agree or differ with the statements made by these patentees in those patents, with reference to the separation of the core plates in a transformer?

527 Mr. BAKEWELL: In the first place I object to that, may it please your Honor, for this reason: Each of these patents to which the gentleman has referred in his question, is long subsequent to the date of the patent in suit. Now, how is your Honor going to be aided or assisted in determining the question, which I respectfully submit your Honor has no right to determine at all, on the issues raised in this accounting, as to the value or utility of the invention, the combination the subject matter of claim 4 of the Westinghouse patent in suit, by ex parte statements contained in letters patent, especially letters patent subsequent in date to the patent in suit, by patentees, assuming for the purposes of this objection, which is a violent assumption because the patents do not warrant it at all, that those patentees are discussing the question of whether or not there be utility or merit in the invention the subject matter of claim 4 of the Westinghouse patent in suit. Here on the one hand they ask your Honor to take into consideration here the question of the utility or degree of utility of the invention, the subject matter of claim 4 of the Westinghouse patent in suit; and now they undertake to try to disprove the utility or extent of that utility of that structure, which the defendant has admittedly infringed, by introducing subsequent patents granted to other patentees for transformers that we know nothing about. They are not in this record. I must most strenuously object to that, may it please your Honor. If such evidence were competent, which I respectfully submit it is not, I have no opportunity to cross examine Mr. Moody, the patentee in one patent, or Mr. Thomson, the patentee in the other patent. I respectfully submit such statements would not be competent if found in a subsequent patent of Mr. Westinghouse, much less are they competent when found in subsequent patents granted to someone else. And the witness undertaking to say and counsel undertaking to state, that statements contained in those letters patent they want to introduce in evidence are statements of persons well recognized as authorities. I dispute that statement in the first place, but if it were true, it is purely an ex parte statement of those persons who are not even produced here as witnesses, and they are ex post facto statements, so far as our patents are concerned.

Mr. FOWLER: We think those patents are competent as writings of persons skilled in this art, of date seven years later, to show that these spaces between the core are not indispensable, or are not essential to a transformer, and that the complainant is not entitled to all this profit it claims on these transformers, every bit of profit which was made in making the transformers.

528 The MASTER: May it not be that these very patents which you wish to refer to, having been issued some years after claim 4 of the Westinghouse patent, were designed for the purpose of avoiding any infringement upon the Westinghouse patent?

Mr. FOWLER: I cannot say. The record in this case show- that the assignee in here is licensee under this patent, this Westinghouse patent. So I cannot see that there is anything in that. It is simply the written statement of these parties, to corroborate what the witness has stated about these open spaces, by writers of well recognized authority in this art, on this subject.

Mr. BAKEWELL: Here is the point: Those are letters patent, of course. It is a presumption, and almost a conclusive presumption, I take it, that those patents were granted for new and useful inventions. That is prima facie. Now grant for the sake of argument that they are new and useful inventions, and grant for the sake of argument, that by reason of those patents the patent of Westinghouse is of little value (I deny that as a fact, but admitting it for the sake of argument) how can a statement in those subsequent patents affect the question of whether or not Mr. Westinghouse at the time he made his invention and applied for a patent, made a new and useful invention, which this defendant has used.

Mr. Fowler speaks about the record in this case showing that the General Electric Company is licensee of the patent in suit. The record before your Honor does not show that. But admitting that to be true, non constat they may have a license from Westinghouse for a certain form of transformer, and then have taken these patents for another form of transformer. If the record does show that the General Electric Company is licensee, and Mr. Fowler speaks of the General Electric Company as the assignee of the particular letters patent to which they refer, what does that tend to show, if anything? It tends to show that the General Electric Company has recognized commercially the utility of the particular invention, the subject matter of claim 4 of the patent in this suit. And it has also recognized, commercially, the utility in other forms of transformers, of patents later in date.

The MASTER: I have very serious doubts whether those patents can be used in that way, in the question of mitigation of damages for the use of claim 4, but I think I will allow them to go in, subject to the objection. I cannot at present see what the materiality of them may be, but counsel may be able to show some connection.

529 Counsel for complainant excepts to the ruling of the Master.

A. In the patent of Thomson, referred to, he make- special arrangements for keeping the copper coils cooled by means of spaces between the coils and between the coils and the core. Referring to this construction Thomson says, on page 2, line 21 of his specification: "By the construction described, I am enabled to build a transformer in which no arrangement need be used to cool the iron core K, it being allowed to run as hot as may be under the condition of service. It might, however, be provided with openings for ventilation if desired, but when such spaces are omitted it enables me to reduce the length of the primary and secondary coils and thus the C2R loss (that is the loss due to the coil resistance) is reduced."

I do not understand that the inventor here means to say that the iron core is to be allowed to run as hot as it is possible to make it, but that it may be allowed to run as hot as may be, when properly designed.

Mr. BAKEWELL: I object to that statement of the witness. An expert, and this witness is called as an expert, may construe language used in a specification, technical terms of a patent; but he goes entirely out of his province when he undertakes to put a

special construction, or substitute for or add to subtract from anything contained in the specification of the patent. Here the witness undertakes to read from the specification, and proceeds to state what he does not understand from that.

The MASTER: I take it the witness is proceeding to put his construction upon it.

Mr. BAKEWELL: Not construing any technical terms in the patent. If that were true, there would be no occasion for the re-issuing of patents. The court cannot reform a patent.

Mr. FOWLER: I submit the witness should be allowed to make his answer without interruption.

Mr. BAKEWELL: When a witness goes outside the patent or into what I conceive to be irrelevant and incompetent matter, I take it it is my right to object; otherwise he gets it on the record without my having an opportunity to examine it or pass upon it. The answer is not responsive to the question. You ask what the patent set forth, and not what the witness may inject into the patent.

The MASTER: I think this is preliminary to another question, and it is proper the witness should state what the patent claim is, and in response to further questioning he may explain.

530 A. In the Moody patent referred to, I quote from page 1, line 16; "It has been customary to provide spacing blocks, which are inserted between the groups of laminæ; but this construction is objectionable because it takes up part of the space necessary for the iron of the core, because it impairs the magnetic circuit, and because it uses more wire than would otherwise be necessary in getting the number of turns required for the ratio of transformation."

He says again, on the same page, line 81:

"It will not suffice as a substitute for my invention to use laminæ having openings or holes punched or formed therein which afford channels for the cooling fluid but which do not allow such fluid to circulate near to the coils, as it is not so essential that the iron laminæ themselves be kept cool as it is that the copper coils be not allowed to heat.

In fact, a high temperature of the iron is advantageous provided that at the same time the copper coils are kept cool, since both the loss by hysteresis and that by eddy or Foucault currents in the iron are less at high temperatures, while the temperature of the copper must be kept low to prevent danger to the insulation and increase of loss by increase of its resistance, and this condition is the preferred one in the use of a transformer constructed according to my invention."

All of the statements made in these patents I have quoted, are true. It is, of course, however, true that if the heating of the iron core is pushed too far, that is to say, if the transformer is not properly designed, aging might result, would result; it would cause this advantage described to become less and less as the transformer became older. That is to say, as it was used for longer and longer time. And here, therefore, also it is necessary in the design of a transformer to make a compromise between the efficiency attainable in the early life of the transformer, and the average efficiency

during the term of years of service. In other words, I should agree exactly with what these writers have stated, it being all true. Remembering, however, that the words used are, after all, relative; and that when heating of the core is declared desirable in order to reduce core losses, it should not be understood that this heating should be pushed to extremes.

At this point recess was taken until two o'clock.

After recess the following proceedings were had:

Q. 140. Will you please state what standing in the electrical art, and particularly in the transformer art, the inventors of the two patents that you have referred to have?

531 Objected to by counsel for complainant as entirely incompetent and immaterial. Those statements in the patents must be taken as mere statements of the patentees as to their inventions, and cannot be considered as statements binding upon us, in the slightest degree. We are not the party making the statements; they are not statements made in this case, under oath, so we could cross examine those witnesses. If those men were produced here as witnesses to give their testimony we would have a right to cross examine them. I respectfully submit that it — not only objectionable for the reasons already stated, but also objectionable for the reason that this witness does not show he is qualified to speak as to the standing of these gentlemen. I made the objection that it is incompetent, irrelevant and immaterial.

The MASTER: It seems to me to be immaterial, but the witness may answer the question. That may be some materiality shown.

Counsel for complainant excepts to the ruling of the Master.

A. Mr. Moody, one of the patentees mentioned, has general charge of all of the mechanical and electrical designing in the General Electric Company, and is regarded as one of the best designers of transformers in the country. That is his general reputation. I have not the pleasure of his personal acquaintance, but I am merely speaking of his general reputation, as I have found it by references made to him in various publications.

Elihu Thomson is an eminent man of science, and also well known as an inventor and practical designer of electrical machinery. His work formed the nucleus of the Thomson-Houston Company, which was one of the principal companies afterwards consolidated into the General Electric Company, and he is generally regarded as one of the foremost electrical engineers and scientific men in the country.

Q. 141. Please compare "Complainant's Exhibit Westinghouse Model" with defendant's type of transformer, as shown at page 168 of the printed record in this case, and state what, if any difference there is between such transformers, with reference to spaces between the core, and *what if any difference there is between such transformers with reference to spaces between the core, and* what if any difference of operation is caused thereby

Mr. BAKEWELL: That is objected to as incompetent and
532 irrelevant, in view of the distinct admission found in paragraph nine of defendant's Answer in this case, which is at page 13 of defendant's printed record in this case, in which it is distinctly admitted by the defendant, as follows:

"And this defendant admits that it has, since the 12th of July, 1887, and subsequently to the assignment to the complainant, within the eastern district of Missouri, and elsewhere throughout the United States, made, used and sold the devices or apparatus which embody the invention or discovery in claim 4 in said letters patent."

I respectfully submit that it could not be more distinctly admitted by the defendant than is admitted by the defendant in the quotation from its Answer above referred to, that defendant has infringed claim 4 of this patent. I, therefore, respectfully submit that in view of this admission of the defendant, which must be taken most strongly against this defendant, and upon which admission the decree in this case was made, that it does not lie in the mouth of the defendant now to select one form of an infringing device made by the defendant, and ask this witness to make comparison between that form of device and claim 4 of the patent, in view of the admissions of the Answer, and in view of the decree in the case, finding that the defendant has infringed claim 4. Not only this, but we have the distinct admission of Mr. Layman in his testimony before the Master, giving an account of the number of infringing transformers embodying the invention, the subject-matter of claim 4 of complainant's patent in suit, which have been made and sold by the defendant. I do not see, in view of this, how it is material or immaterial to make any admission, since there is an admission that there is a distinct infringement of the invention the subject matter of that claim.

Mr. FOWLER: The type of defendant's transformer referred to in the question, is the type of transformer which was held infringed in this case, and the only transformer which was held to infringe. We think we have a right to show to what extent we have employed the advantages of the patented structure and this question is directed to that point; not at all to the point that we have not used the patented structure. It is merely directed to the point to the extent that we have employed the advantages or benefit said to result in this patent from the separation of the core plates. The question goes to the extent.

Mr. BAKEWELL: In counsel's last statement he has again, as he has previously in conducting the testimony before this Master, undertaken to state the invention of this patent, not in the language
of claim 4, but in his own language. Claim 4 is before the
533 Master. The claim is distinct. It is for an entire combination, the claim being in the following words:

"The combination, substantially as described, of an electric converter, constructed with open spaces in its core, an inclosing case, and a non-conducting fluid or gas in said case, adapted to circulate through said spaces and about the converter".

This invention was construed by the circuit court and the Circuit Court of Appeals, in the Carbide Case, and the defendant by its Answer admits it is bound by that decision and the finding of the court in that case. Furthermore, the defendant in this case distinctly admits, in general terms, the infringement of this claim of the patent. I insist upon it that this inquiry is not a proper one to make upon this examination.

The MASTER: The question of infringement or non-infringement is, of course, not before the Master. The decree of the court has established the infringement. The only inquiry before the Master is, what has been the profit to the defendant from the use of the infringement. And I take it the defendant has the right to show, if it can, a minimizing effect from the use of the infrigement. That does not attack the validity of the patent or the fact of the infringement at all. But the defendant is certainly entitled to show, if he can, anything which results in a diminution of damages. Whether this particular inquiry goes to produce that effect, I cannot now tell; its particular relevancy is something that I cannot at this stage of the examination predicate at all. The question may be answered, subject to the objection of counsel, with the understanding that counsel for defendant will attempt to connect it, in some way, with the question of mitigation of damages.

Counsel for complainant excepts to the ruling of the Master.

A. In the complainant's Exhibit "Complainant's transformer, the sheets of iron forming the iron core, stand on edge, in a vertical plane. This core is divided into sections, separated from each other by tubes of fiber, or other insulating material, in order to permit ascending columns of heated oil to rise between these sections in the core plate. This transformer is intended to keep the core plates cool. The cooling of the copper coils is somewhat impeded by the arrangement of these tubes which separate the core plate and the core into sections. In the defendant's transformers, as illustrated in Volume 1 of the printed record in this case, at page 168, the iron plates forming the core of the transformer are in a horizontal position, and the sections into which the iron core is divided are
534 also horizontal. This fact, that the sheet of oil between the sections is a horizontal one, practically deprives the transformer of any advantage which cooling of the core might have when such cooling becomes necessary, because the circulation of the oil is thereby impeded. The cooling effect of the oil parts does not, therefore, appreciably exist in the defendant's transformer, as illustrated in the page of the record referred to (page 168, vol. 1) and in my opinion these spaces within the core do not have any appreciable value in contributing to the successful operation of the transformer. On the other hand, the existence of these spaces necessarily involves a diminution in the amount of iron that it is possible to use, and in that respect these spaces are a disadvantage.

I do not mean to be understood, that the division of an iron core into sections, separated by such spaces, does not have, under some circumstances, a distinct advantage.

I mean to say, it also has it disadvantages; and that in some

cases where transformers have an output of fifty kilowatts or less, I think the disadvantage of these spaces is greater than the advantage.

If in the defendant's transformer, as illustrated in this record, these spacing blocks were to be eliminated, so that the spaces in the core no longer existed, the transformer would operate as successfully as when those blocks are present. I should not expect any material change in the running temperature to be produced by the elimination of these spacing blocks, and the spaces in the core, incidental to the use of these spacing blocks, as shown in this illustration in the record referred to in the question.

Every transformer must be designed in such a way as to provide for a variation in the temperature; this is incidental to the fact that such transformers are surrounded by air, the temperature of which varies. The variation in the external temperature would necessarily produce a variation in the internal temperature of the transformer; and such variations incidental to changes in the temperature of the room, and certainly those incidental to the variations in the outside air, where many transformers are exposed, are large compared with the variation which would be produced by the elimination of these spacing blocks in the defendant's device, shown in this record referred to in the question.

Mr. BAKEWELL: I- view of the answer of this witness, in which complainant's counsel understood him to state, by reference to the transformer illustrated at page 168, volume 1 of the record in this case, that the spacing strips in the said transformer were of no use, and that in such a transformer there would be no circulation
535 between the open spaces in the core, complainant's counsel desires to call the Master's attention to the fact that the defendant is estopped from taking such a position in this record, for the following reasons.

First, that in respect to that identical transformer, which is an illustration of the transformer in said Carbide suit, it was distinctly stipulated at page 15 of the record in said Carbide suit, which is in evidence in this case, before this Master, as follows: "That the said transformers used as aforesaid by the defendant herein, are constructed and used as shown and described in paragraph 24 of an article which appeared in the issue of January, 1900, of the American Electrician on page 17, a copy of which is put in evidence and marked by the Examiner "Plaintiff's Exhibit American Electrician illustration of Defendant's transformer," and said transformer is described as having primary and secondary coils, composed of thin plates of soft iron arranged in groups, said groups being separated from each other by blocks, thus providing spaces between the groups of plates; the coils and core being enclosed in a metal case containing a non-conducting fluid which circulates through the open spaces in the laminated core."

It is further objected that the defendant is estopped from taking the position that it has not used the invention, the subject matter of claim 4 of the Westinghouse patent in suit, for a useful purpose, from the mere fact that it has used it, and from the fact that by the Answer in this case, at page 11 of Volume 1 of the printed record in

this particular suit, on page 13 of the Answer, the defendant unqualifiedly and without reference to the particular form of transformer illustrated at page 168 of the record, admits that it had made, used and sold, prior to the filing of the Bill of Complaint in this case, transformers embodying the particular invention, the subject matter of claim 4 of this patent.

Now, I respectfully submit, it is incompetent for this witness, testifying in behalf of the defendant, to take the position that the transformer which he refers to and which is illustrated at page 168 of the record in this case, will not operate in the manner contemplated by the patent and covered by claim 4 of the Westinghouse patent in suit, in view of the fact that the Circuit Court and the Circuit Court of Appeals, in the Carbide case, distinctly found that it would, and that the defendant, in the Carbide case, distinctly so admitted on the record, by the stipulation found on page 15 of the record in the Carbide Case.

Mr. Fowler: If your Honor pleases, I do not understand the witness to have said that there would be no circulation whatever of oil in the horizontal spaces in defendant's transformer. All
536 I understand the witness to state is, that the circulation in that construction will not be as effective, and carry out the objects of the invention as successfully as the construction shown in Complainant's Exhibit of Complainant's Westinghouse Model. I submit that this answer shows the extent to which the spacing of the core plates in defendant's transformer has contributed to the success of defendant's transformer, and I submit that the answer is competent and relevant.

Mr. Bakewell: I wish to draw the Court's attention to these certain fundamental principles. In the first place, it has been decided, and there are no decisions to the contrary, that the very fact that the defendant may in a particular case have succeeded——

Counsel's statement of what the witness says is not in harmony with what the witness actually testified to. The witness wants your Honor to believe that this structure is just as efficient when these spacing strips are taken away as when they are there. The Court having determined that that is the invention of the patent, they having admitted the invention of the patent, and not disputing the question of infringement at all, and now for the first time, in taking testimony before a Master on the accounting, they try to raise an issue which, if they had chosen to raise at all, they could have raised by their answer in both the Carbide case and in this case, to-wit, the issue of non-infringement. The Court having determined that defendant's structure and ours are absolutely identical, the issue is not want of utility in complainant's patent. One thing the Court has distinctly found in the Carbide case, in both the Circuit Court and the Court of Appeals, not only that there is utility in the patent, and not only that there is infringement of this patent by this structure, but that there is great utility in the structure of complainant's patent. This same expert was on the stand before, to show that there was no invention in this patent. The Court overruled him as to that. He and counsel are now coming back trying to reargue before your

Honor a question which has been absolutely disposed of, and on the pretense that now they are raising this question to go to the measure of profits, in the case of a decision which says, conceding all they say is true and that complainant's structure is not as useful as defendant's, nevertheless that does not affect the question at issue, or the measure of damages.

Mr. FOWLER: I wish to correct Mr. Bakewell's statement that this witness has testified that there was no invention in this patent.

537 This witness was not in the Carbide case and was merely called in this case to establish the fact that there was no infringement by the defendant by the other form of transformer shown by this other model here in this case. And the Court not only sustained the defendant in that position but quoted this witness' testimony in its decision on that point.

The MASTER: So far as this testimony is concerned, it is perfectly clear that it would be wholly irrelevant if it were attacking the validity of the patent. That has been established by the decree of the Court. There is no question whatever before the Master except the measure of damages. Now boil it all down, as I understand it, the witness has merely stated that where the transformer is arranged horizontally, it is less effective and the circulation less rapid than where the plates are vertical. How this is going to be made applicable to the question of mitigation of damages, it is impossible for me to say. So far as I am able to pass on it now, I should be obliged to hold it to be irrelevant. But I can not say it may not be relevant when the whole of the testimony is before me. And I wish to say right here, that in matters of this kind it has always been my habit, and I have never been censured for it, to allow the testimony to go in, subject to the objection. Otherwise, I do not see how, when I come to make my summing up and finding in the matter, it would be possible for me to correct any errors that I may have fallen into in the course of the hearing; and I do not see how the Court could correct the errors which I make, unless the testimony were before the Court which was attempted to be introduced before me. I prefer in all these cases to have the testimony to go in subject to the objection. The weight or effect or relevancy of it I will determine as best I can, in my finding. But I do not see how the Court could correct my errors unless the testimony was before it. I do not mean, when I say that the testimony may go in subject to the objection, that I consider that testimony to be relevant; it does not follow that I do; I can not tell whether it is relevant or not. In this case, so far as my present light goes, it seems to me wholly irrelevant, but I take it that it is offered in good faith as having some bearing on the measure of damages, and I think it is my duty to take the testimony subject to the objection.

Mr. BAKEWELL: And I, also, consider it my duty to endeavor to make my position well understood. In a certain sense, if I have not misunderstood the Master, almost any testimony could go in.

538 The MASTER: That does not follow. If counsel were to offer the dimensions of a barn I wouldn't allow it to go in. I

should like to have these objections preserved in such shape that I can understand them. I want to make my position clear as to why I admit this testimony.

Counsel for Complainant excepts to the ruling of the Master.

Q. 142. You have referred to the aging of iron in transformers: Will you please state what is the cause of such aging in transformers, and if you have at hand any authorities in support of your opinion, please refer to the same.

Objected to by counsel for Complainant for the same reasons already stated.

The MASTER: The testimony will be taken subject to the objection.

Counsel for Complainant excepts to the ruling of the Master.

A. The aging of iron or steel used in transformer cores is well known to be caused by the heating of these cores. And this heating may be done by heating the cores in an oven before they are put into the transformer. There is nothing, therefore, distinctly electric or magnetic which is involved in this aging. If fresh iron is put in a transformer the core loss will be a certain definite or average amount, varying somewhat with the iron used, and varying in a way that can be determined only by experiment on the transformer after it is built. If the same kind of iron is first heated in an oven to a moderately high temperature, this iron will show the effect of age; and the core loss will be greater when this iron is made up into the core of the transformer: If the iron is heated still more highly, the core being put into the transformer, the effect of age is still more distinctly shown. It may, however, be heated sufficiently so that the effect of aging begins to disappear, and after the iron has aged, it may be restored by annealing. This consists in heating the iron to a temperature much above that of the operating temperature in the transformer, and allowing it to cool slowly. But there is great difference in the kind of iron that is used, and none of the manufacturers of iron can deliver iron to the electrical manufacturers and guarantee what its properties will be as regards aging. On an average, they can deliver iron which is considered satisfactory, and the iron that is used is, on the average, found to behave in a satisfactory way, so long as the temperature involved in the operation of
539 the transformer does not rise above a temperature of ninety degrees Centigrade (or 193 degrees Fahrenheit). The general practice is to allow a rise of temperature of fifty degrees Centigrade (or 112 degrees Fahrenheit) above the temperature of the surrounding air, but this rule is somewhat indefinite, because the temperature of the surrounding air may vary considerably, and certainly for transformers that are exposed to outdoor temperatures. The real effect in aging, of course, depends not upon the rise of temperature above the surrounding air, but upon the actual temperature reached by the iron. This means, therefore, that in the designing of the smaller transformers they must be so constructed as to permit of considerable variation in the working temperatures of the iron without producing serious damage from aging. And the

quality of the iron used is such that within the limits of temperature mentioned the aging produced is permissible in practice.

I have here a publication of the General Electric Company, which consists of various papers prepared by well known electricians and engineers——

Mr. BAKEWELL: I should like to have the matter submitted to me so that I may object to it before he proceeds with the testimony.

Counsel for Complainant examines pamphlet.

Mr. BAKEWELL: I object to the witness referring to this alleged publication, which appears to be a pamphlet entitled "Aging of Transformer Iron, by the General Electric Company" and which appears to have been published October 1, 1900, on the ground that it is utterly irrelevant and immaterial to any issue in this case, and can not in any way affect the question of the utility of the invention of the Westinghouse, nor the utility of the Invention of the Fourth Claim of the Westinghouse patent, as used by the defendant. Furthermore, the statements in this publication are not binding in any way upon the defendant in this case. They are certainly statements made after the date of the Westinghouse patent in suit, and they are not our statements, and can not even have as much weight, if they were competent, relevant, and material, as the testimony of the witness himself under oath. It seems to me this is a clear case of dragging into this record matter which is utterly irrelevant, incompetent, and immaterial.

Mr. FOWLER: Our object here is to give the Master all the light we can upon this subject of the aging of iron, and to have the
540 witness state whether or not he agrees with these authorities, so that the Master may have all the facts before him on this question of aging, which is one of the questions involved in this case, and has been referred to in the Redirect Examination of Complainant's witnesses in chief, and we submit that the fact that this is subsequent to the Westinghouse patent makes it all the more relevant, as it is an up-to-date statement of the consequences of aging and what is the cause of aging. This is a pamphlet distributed by the General Electric Company, probably one of the largest electrical companies in the world, upon this subject. If the statements contained therein are not true, the complainant can in its rebuttal evidence exclude them, but it seems to me the Master ought to have all the light he can possibly get on this subject.

Mr. BAKEWELL: It is not a question of disproving statements. I am objecting on the ground that the pamphlet is utterly irrelevant and that the statements therein contained are absolutely incompetent, irrelevant, and immaterial to the question before the Master.

The MASTER: I do not see the materiality at present, but it may go in subject to the objection.

Counsel for complainant excepts to the ruling of the Master.

A. On page 16 of this publication, in a paper by W. E. Goldsborough, of the Purdue University, I find the following statements—and I may say, before making the quotation that Mr. Goldsborough was the Chief of the Electrical Department of the World's Fair Ex-

position in St. Louis. The writer states, on page 16, near the bottom of the page: "The result of a large amount of experimentation has been to show that no two samples of iron may be expected to give the same 'aging' characteristic, even when subjected to exactly the same influence; and just as two samples cut from the same sheet often show differing magnetic characteristics, just so is it not unusual to find aging characteristics differing under similar circumstances. At the present time it is not generally known what processes may be successfully followed out in the production of what is termed 'non-aging iron.' This valuable quality depends in a large measure upon the chemical constituents and physical treatment to which the iron is subjected."

And again, in the middle of the next page, I quote: " 'Non-aging' iron in the condition in which it is commercially obtainable possesses an hysteretic constant having a stability that is quite surprising when compared with laminated iron not especially manufactured to minimize its aging tendencies. So long as samples of good
541 qualities of this metal are not subjected to temperature in excess of 200 degrees Fahrenheit (93⅓ degrees Centigrade) no very marked hysteresis growth or aging, is to be expected. Although this is strictly true of a number of samples tested in the Purdue laboratories, it is not true of all, and tendencies to aging are usually detected when sustained temperatures of 125 degrees Fahrenheit (51 6/10 degrees Centigrade) are reached."

Again, beginning on page 85 of this publication, in an article furnished by J. A. Capp, I find the following statement: "We must know the process of manufacture, whether iron or steel, and the full schedule of the heat sequence, to which a given sample has been subjected during manufacture, in order to form any opinion of its probable behavior when exposed to aging influences, i. e., to temperatures above the ordinary atmosphere. We later found, that, given the proper composition of raw material (we have since found that this composition may vary within unexpectedly wide limits without noticeably affecting final results), it is possible with proper heat treatment during the manufacture to produce steel material that will exhibit no aging at a less temperature that 85 degrees Centigrade, and may show none at 100 degrees Centigrade, or even 125 degrees Centigrade, but that it is commercially impractical to guarantee this. A moderate amount of aging is very liable to be shown on exposure to these higher temperatures if continued long enough, and if heat treatment has not been proper, aging is certain to occur at much lower temperatures."

"Owing to the fact that the necessary heat treatment is in a sense special, it requires particular attention on the part of the rolling mill attendants, which is not apt to be given when there is a large amount of work on hand, and consequently the heat treatment is slighted. When such is the case, standard results can not be obtained."

It is of course understood in reference to the temperatures above mentioned that 100 degrees Centigrade is 212 degrees Fahrenheit or the boiling point of water. These statements are in accord with

the common knowledge existing among engineers concerning the aging of iron under various conditions.

The MASTER: I want to ask you whether there is any known explanation of the effect of aging of iron, at a low temperature long continued, or the annealing of iron at a high degree of temperature long continued: Isn't is a fact that the results only are known and the causes are not?

A. I think that is a correct statement. There is probably involved a crystalline or large granular structure in the iron produced
542 by annealing, and the effect of aging consists probably in the breaking up of this crystalline structure. But how this is accomplished mechanically, of course, is somewhat difficult to explain. I do not think it is understood. We can not tell why iron possessing this crystalline structure should possess the property which is usually called "non-aging." The results are only known of course by experiment.

By Mr. FOWLER:

Q. 143. Please state specifically whether you agree with the statements which you quoted in your last answer or do not agree with the same.

Mr. BAKEWELL: The objection heretofore made to the former question to the witness, as well as to the pamphlet from which he undertook to read, is here repeated, on the ground that it is incompetent, irrelevant, and immaterial.

The MASTER: It will be taken subject to the objection.

Counsel for Complainant excepts to the ruling of the Master.

A. I agree with these statements quoted. They represent the best information attainable on this subject, and this information has been obtained by the experiments of men who are competent to investigate these subjects experimentally.

[Q. 144.] Mr. Johannesen, a witness called on behalf of the Complainant, in re-cross examination before the Master in this case, has testified as follows:

"Re-X Q. 112. You have been asked in your re-direct examination about the recognized value of oil-cooled transformers having open spaces in the core. I ask you if you do not know it to be a fact that the General Electric Company in its transformers uses no spaces in the iron core from 1 K. W. up to 50 K. W. transformers?

A. I am aware of that fact; but the transformer would be better if it had spacing strips in the core, as far as the aging of the iron is concerned and the operating expenses of the station after the end of a certain period.

Re-X Q. 113. You have spoken in your re-direct examination of the resistance of the iron to reversal of magnetism. Is it not a fact that when the iron is hot is has less resitance to the reversal of magnetism than when the iron is cooled?

A. Yes, that is a fact; but if the iron is continued in the very hot state, this loss increases more rapidly, and at the end of a certain period the loss in that transformer would be greater than it would have been if the core had open spaces in it.

543 Re-X Q. 114. Give an example.

A. Take, for instance, two transformers built exactly to have the same core losses, one with the spacing strips in the core and one without the spacing strips in the core, in the first test on these transformers the core loss would be greater in the transformer which run the cooler, the one that has spacing strips in the core, at operating temperatures, but at the end of the certain period, the loss in the transformer which run the hotter, which did not have the spacing strips in the core, will exceed the loss of that with the spacing strips in the core, and this difference is due to a greater rate of aging in the transformer without the spacing strips in the core.

Re-X Q. 115. Would one or two degrees rise in temperature, or even five degrees rise in temperature, cause a substantial aging in the iron.

A. If one transformer operated five degrees hotter than another, the rate of aging, would, of course, be greater, and as to the amount of that aging, I am not prepared to state.

Re-X Q. 116. Would one or two degrees rise in temperature make any substantial difference in the aging?

A. I am not prepared to answer that.

—. What have you to say as to this testimony of Mr. Johannesen's.

Objected to by counsel for Complainant as utterly immaterial.

The MASTER: The testimony will be admitted subject to the objection.

Counsel for Complainant excepts to the ruling of the Master.

A. It is of course well understood that a small transformer has a greater amount of radiating surface per kilowatt of output than a large transformer. This question first answered by Mr. Johannesen has reference to small transformers, which are, therefore, better capable of taking care of themselves, so far as radiation is concerned, than a large transformer of over fifty kilowatts. In such smaller transformers, where the core is laminated or spaced into sections, and these spaces are vertical in position, there will be of course cooling of the iron core due to the spaces, and this cooling is certainly an advantage. But these spaces also have a distinct disadvantage in that they make it impossible to use as large an amount of iron as would be used if the spaces were abolished and their places were filled with iron. This for the same output would result in the pro-
544 duction of less heat. The formation of these spaces, therefore, makes it necessary for the remaining iron to carry the load imposed upon it, thus resulting in an increase in the amount of heat developed, which of course the spacing tends to take care of.

Now, in small transformers, particularly where the spaces in the core are horizontal, the introduction of these spaces in the core, while it does perhaps act slightly in the way of an advantage, acts equally, or even more, as a disadvantage. And it is for this reason that the General Electric Company does not use these spaces in the core for its smaller transformers.

I understand Mr. Johannesen in his answer to refer only to the advantage produced by the increased ventilation or cooling, and he neglects to consider the disadvantage resulting from the employment

of a smaller amount of iron. When both of these considerations are taken into account, I think the General Electric Company is right and is justified in building transformers of below fifty kilowatts output without these spaces; and I therefore can not agree with this first answer of Mr. Johannesen, since it considers only a part of the problem which is involved in the designing of these transformers.

In answer to Re-X Q. 113, Mr. Johannesen says: "If the iron is continued in a very hot state this loss increases more rapidly and at the end of a cert-in period the loss in that transformer would be greater than it would have been if the core had open spaces in it." Now the fact is, that these transformers are not operated under working conditions such as are specified in this answer. Transformers are so designed that there is of course a rise in temperature found to be permissible, but this rise in temperature is not what would be called "a very hot state." This answer does not, therefore, address itself to working conditions.

In answer to Re-X Q. 114 where Mr. Johannesen gives an example, in effect stating that when the removal of the spacing strips in the core produces a great rise of temperature over that which is observed in the same kind of transformer having these spacing strips, that the transformer running at the higher temperature will show a greater rate of aging, I have to say that this would depend entirely on whether the removal of these spacing blocks would really produce the rise in temperature assumed in the answer. It does not at all follow that this would be the result of the removal of the spacing blocks. In the transformers used by the defendant, as exemplified on page 168, Vol. I of the printed record——

Mr. BAKEWELL: I wish to call the attention of the Master to the fact that this witness is making a lot of arbitrary statements. There is evidence in the Carbide case that this particular trans-
545 former is used. There is evidence in this case that the defendant is using the transformer in suit. I object to this testimony.

A. (continued).—where the spaces in the core are horizontal, there would be no appreciable rise of temperature due to the removal of the spacing blocks; and therefore this answer of Mr. Johannesen does not address itself to the apparatus used by the defendant and complained of by the Complainant.

In answer to Re-X Q. 115 Mr. Johannesen states that a transformer operated five degrees hotter than the other, the rate of aging would of course be greater; but is not able to state the extent at which this rate of aging would increase.

Now, the average transformer must necessarily be designed with a view of greater ranges of temperature than this, on account of the fact that the temperature of the surrounding air will vary by more than five degrees, and such variations in temperature, therefore, do not produce results which are considered commercially important. This being true, of course it would be also true that a variation of two degrees is of no commercial importance. Of course I do not mean to be understood that in case of two transformers made from iron as near alike as is feasible, it might not be possible to detect a

difference in the rate of aging due to differences of temperatures of two or five degrees. But this question involved is not an academic question, but one which must address itself to practical and commercial conditions.

Counsel for complainant objects to this answer on the ground that it is argumentative, irrelevant, and immaterial and calls the attention of the Master to the fact that this answer is based upon a question which quotes from a lot of questions put on re-cross examination to the witness Johannesen, and which re-cross questions put to the witness Johannesen were objected to in the record, as will appear from Mr. Johannesen's testimony, objections being made by complainant's counsel. Mr. Johannesen was asked whether or not the General Electric Company in the manufacture of these transformers used no spaces in the iron core. It is utterly irrelevant and immaterial in this case what the General Electric Company may do, especially in view of the fact that the record of the Carbide case is before the Master, and from the record in the Carbide case and from the testimony of Walter S. Moody (who is spoken of so highly by this very expert) it appears that the General Electric Company has manufactured various forms and types of transformers. Complainant's counsel makes this objection to the answer of the witness to illustrate
546 the fact that this line of examination tends to carry one far afield from any proper issue presented to the Master on this accounting and such testimony does not in the slightest way tend to show, even — it were competent to show, that the invention subject matter of Claim Four of the Westinghouse patent, is not useful; much less does it tend to show that the transformers accounted for by the defendant in this case which admittedly embodied in their construction the particular invention the subject matter of Claim Four of this Westinghouse patent, are not useful; especially in view of the findings of this Court and of the Circuit Court and the Circuit Court of Appeals in the Carbide case. Furthermore, even — it were true in point of fact (a thing which we do not admit) that there was no especial advantage in the defendant's transformer, which embody in their construction the invention the subject matter of Claim Four of this Westinghouse patent, it does not lie in the mouth of the defendant to say there was no utility in such a structure, when it admittedly manufactured and sold them in large quantities. Complainant's counsel makes this objection to the answer in order to emphasize his position in the record and endeavor to bring the mind of the Court back to what the real issues are in this accounting, as complainant conceives them to be.

Q. 145. What do you understand to be the permissible rise in temperature, in practice, in transformers?

A. As it is generally stated, the rise in temperature should be kept at or below fifty degrees Centigrade above the temperature of the surroundings of the transformer. This of course assumes average temperatures in the surrounding air approximating twenty degrees Centigrade.

Q. 146. How does operating transformers under overload, or at

over pressure, or at different frequency than for which they were designed, affect them.

A. The iron loss in the transformer is the same for no load as for a full load. The copper loss increases with the load. If an overload on the transformer resulting in a large copper loss, should result in producing a greater amount of heat than could be dissipated by the oil, this would of course mean that the temperature of the iron under these running conditions, would be increased by the overload. This increase of temperature of the iron would be an advantage and a disadvantage; it would be an advantage in that it would reduce the iron losses during the earlier life of the transformer, and it would shorten the effective life of the transformer, because it might involve being pushed to extremes, a more rapid aging of the iron. Operating the transformer at a higher primary pressure than that for which it was designed would increase the iron loss, both for no load
547 and for full load, would result in the higher temperature of the iron, and of course would have its effect in increasing the rate at which the iron would age. The extent of this effect would of course be determined upon the actual rise in temperature of the iron produced by the abnormally high voltage applied to the primary of the transformer. Similarly, operating the transformer at a lower frequency, that is to say, with a lower speed of revolution of the generator, would produce a like effect in accelerating the aging of the iron. And here also the question as to whether this would be permissible, would depend upon the rise in temperature thus produced, and the extent to which the temperature would rise.

Counsel for defendant here offers in evidence the two patents referred to by the witness in his previous testimony, being the patent to Walter S. Moody of Lynn, Massachusetts, assignor to the General Electric Company of New York, No. 539,876, patented May 28, 1895. Also the patent to Elihu Thomson of Swampscott Massachusetts, assignor to the General Electric Company of Boston, Massachusetts, No. 516,850, dated March 20, 1894; and asks that the same be marked respectively "Defendant's Exhibit Moody Patent" and "Defendant's Exhibit Thomson Patent."

Counsel for Complainant objects to the introduction in evidence of each of the said patents on the ground that they are irrelevant and immaterial to any issue in the case, and so far as the same may be introduced, on the ground that the statements of the patentees, contained in the specifications thereof, cannot be used as authority in any way affecting any issue on this accounting. And same are objected to as incompetent.

The MASTER: The Exhibits are admitted, subject to the objection.

Counsel for complainant excepts to the ruling of the Master.

Counsel for defendant also offers and puts in evidence the pamphlet referred to by the witness in his testimony, which pamphlet is entitled "Aging of Transformer Iron," published by the General Electric Company, under date of October 1, 1900, and requests that the same be marked "Defendant's Exhibit, Pamphlet of General Electric Company 'Aging of Transformer Iron.'"

Counsel for complainant objects to the introduction in evidence of this pamphlet, as incompetent, irrelevant and immaterial.

The MASTER: It is taken subject to the objection.

548 Counsel for complainant excepts to the ruling.

Counsel for complainant states that he will stand on the position already taken in the record with respect to questions put to this witness, and that he declines to cross-examine him.

At this point the further hearing of testimony was adjourned by the Master to Thursday, October 26, 1905, at 11 o'clock a. m.

ST. LOUIS, MO., *October* 26, 1905.

Met pursuant to adjournment as above on Thursday, October 26, 1905, at 11 o'clock in the forenoon, at the office of Messrs. Fowler & Bryson in the Commonwealth Trust Building, St. Louis, Missouri.

Present: Mr. H. H. Denison, Special Master; Mr. Paul Bakewell appeared in behalf of the Complainant, Mr. A. C. Fowler appeared in behalf of the Defendant.

Whereupon the following proceedings were had:

THOMAS GRAY, a witness of lawful age, being duly produced, sworn, and examined on the part of the defendant, testified as follows:

Direct examination.

By Mr. A. C. FOWLER:

Q. 147. Please state your name, age, residence, and occupation.

A. Thomas Gray; 55 years; Terre Haute, Indiana; vice-president and director of the Department of Mechanical and Electrical Engineering in the Rose Polytechnic Institute of Terre Haute.

Q. 148. What experience have you had both theoretical and practical which qualifies you to testify concerning electrical matters, and particularly with reference to electrical transformers?

A. I am a graduate of the University of Glasgow, Scotland, in engineering science. Whilst a student at the University I was for four years a special student under Sir William Thomson, now Lord Kelvin, in experimental physics; the principal part of my work during that time was in the investigation of problems in electricity and magnetism, particularly in connection with what he has called in his publication the electro-dynamic properties of metals. After graduation I taught electrical engineering in the Imperial College of Engineering at Tokio, Japan, for a period of three years, and on returning to Scotland from that country I became assistant to Sir

549 William Thomson in connection with his investigational work. That work was of similar nature to that which I had previously performed as a student under him with the addition that I had charge of investigations bearing on standards for electrical measurements. I then became electrician to the Hammond Electric Light and Power Company and occupied that position for something less than a year. This company operated under the Brush patents and also under patents by Ferranti for alternating currents

and under dozens of patents of Sir William Thomson for alternating currents. After leaving the Hammond Company I became chief representative of the firm of Sir William Thompson and Professor Jenkins as engineers for what they called at that time the Mackay-Bennett system of trans-Atlantic cables. Those cables now form the Commercial Company's cables. I had full charge as their representative of the supervision of the manufacture and the laying of those cables including all the tests and certification with regard to the fulfilment of the specifications, etc. After the completion of their contract, I remained with Sir William Thomson for two or three years in the capacity of his assistant, doing work of a similar nature to that to which I have already referred. After leaving Sir William Thomson's service, I came to the United States and took the position of Professor of Dynamic Engineering in the Rose Polytechnic Institute. My duties in this professorship included the teaching of applied mechanics, thermo-dynamics, and the dynamical principles involved in the designing of electrical dynamic machinery. I continued to hold that professorship and still teach the principles of electric dynamic machinery and some part of applied mechanics. My other duties in the electrical department prevent my teaching as much as I did in former years.

During the course of all that experience I have paid particular attention necessarily to the development of electric dynamic machinery, transformers, and other apparatus. I have made some special studies with regard to transformers and their design, and about two years ago communicated a paper on the principles of transformer design to the "Electrical World." I was some time ago asked by Macmillan & Company of London and New York to prepare a series of text books on dynamos, transformers, motors, the use and distribution of electrical energy, including telegraphs, telephones, etc., and have for the last two years devoted considerable time to the preparation of one volume of that series the name of the volume being "On Dynamo Motors and Transformers." This has also led me to study carefully the present condition of the art in connection with transformers.

In regard to scientific standing, I am Fellow of the Royal Society of Edinburgh, member of the British Association for the Advancement of Science, of which Association I have been a member of a number of sub-committees. I have also received grants from the Royal Society of London to defray expenses of experimental investigations relating to the insulating properties of glass, porcelain, and other substances. I am a Fellow and Past Vice-President, being Chairman of the Engineering Section, of the American Association for the Advancement of Science, member of the American Society of Mechanical Engineers, the American Society of Naval Architects and Marine Engineers, the Society for the Promotion of Engineering Education, of which Society I have also been the Vice-President, and also a member of other scientific and technical societies. I am author of the articles on Telegraphs and Telephones in the ninth edition of the Encyclopedia Britannica, and I am author of a volume of Physical

Tables and Data, published by the Smithsonian Institution of Washington, D. C. I was during the publication of the Century Dictionary one of the experts on the definition of electrical terms.

Q. 149. Have you read and do you understand the patent in suit, and particularly the subject matter covered by the Fourth Claim thereof?

A. I have read that patent carefully and believe I understand the patent and the claim referred to.

Q. 150. Please state to what extent in your opinion the open spaces in the core of the transformer contribute to the success of such transformer. Please answer this question with reference to having the open spaces in the core arranged vertically and also with reference to having the spaces between the core arranged horizontally, understanding, of course, the transformer is to be immersed in oil contained in a suitable casing, all as provided for in Claim Four of the patent in suit.

Mr. BAKEWELL: I object to the question as thoroughly incompetent, irrelevant, and immaterial to any issue before the Master. This patent, and Claim Four thereof, have been before the Court, have been construed by the Court; Claim Four of this patent is not merely for the spacing strips between the core, as counsel would seem to indicate by his question, but is for the entire combination of elements as set forth in Claim Four, which has been construed by the Court and which construction of the Court's of this Claim defendant is bound by, as it admits in the answer in this case. Claim Four of this patent in suit as construed by the courts and as it states itself in very plain language, is not in any way limited by the fact, if it be a fact, that the particular transformer which responds to this claim has its core plates arranged vertically or horizontally. The sole question before the Master in this
551 case is as to the profits complainant is entitled to recover from the defendant on account of the manufacture and sale by the defendant of certain transformers which admittedly infringe Claim Four of this patent. For these reasons, I respectfully submit that the question put to the witness calls for testimony that is utterly irrelevant and immaterial to any issue before the Master on this accounting.

Mr. FOWLER: This question is not directed toward the question of infringement whatsoever, but merely to the extent of the profit or damages in this case. It is the same question we had up yesterday.

Mr. BAKEWELL: I wish in addition to my objection already made, in view of the statement of defendant's counsel, to call your Honor's attention to the fact, as appears from the record in this case, that the defendant in this case is a manufacturer and that the profits complainant is seeking to recover from this defendant on account of the infringement of Claim Four of the Westinghouse patent, are not profits due to use of the article, but profits which the defendant has made by the manufacture and sale of the article which is the subject matter of Claim Four of this patent. With

this explanation I simply reiterate the objection I have already made.

The MASTER: The witness may answer the question subject to the objection.

Counsel for Complainant excepts to the ruling of the Master.

A. The advantage to be derived from the subdivision of the core in the way indicated in the patent is, in the first place, largely dependent on surrounding conditions. One of these is the question as to the relative radiating power of the outside of the case, to the ability of the containing oil to carry off the heat from the transformer proper. In my opinion, in transformers of moderate size there will not be any very great advantage in the separation of the iron in the manner indicated, whether the separation be in a vertical plane or in a horizontal plane. In transformers of large size, it is probable that circulation of the oil through the spaces of the kind indicated will come to be of some considerable advantage. If the spaces are so arranged that the oil will effectively circulate through them so as to wash the surfaces of the heated parts. In the transformer indicated in the patent, the circulation of the oil through the spaces between the iron sheets, when the spaces are placed in a vertical plane, will bring the oil into contact with the surfaces of the sheets of iron adjoining the spaces and will also bring the oil in contact with a part of the surface
552 of the coil, thus acting partly to cool the iron by direct contact and partly to cool the coil by direct contact.

Turning now to the latter part of the question as to the effect in the case of horizontal spaces, in my opinion the introduction of such spaces will result in a practically stagnant layer of oil between the successive groups of iron sheets; that this oil will not circulate with sufficient rapidity to materially assist the cooling of the iron and certainly will not carry off any sensible amount of heat from the coil. In fact, my opinion is that the introduction of spaces of that character and in that position is a mistake; that these spaces would be very much better occupied by additional iron, because if we assume that the same quantity of iron is used whether the spaces be placed there or not, the coil length must necessarily be greater in the case in which spaces are introduced, and in consequence, other things being equal, the heat produced by the coils will be greater. Therefore there is more heat to carry off and no sensible increase of cooling power added to the coil. On the other hand, if we assume that the coil length is kept the same but that some iron is taken away to make air spaces, there will necessarily be an increased density of magnetic induction through the iron and since the loss or heating due to this magnetic induction increases more rapidly than the direct proportion of the induction density, there will be more heat in the diminished quantity of iron than there would have been in the original quantity before the spaces were introduced; thus again introducing a requirement that the transformer should be provided with greater cooling capacity when the spaces are there than when they are not there. As a matter of fact, I believe that the temperature of the iron will not

differ by a material amount either way, due to the introduction of these horizontal spaces.

There is one point which I think should be clearly kept in mind in connection with the cooling of the iron in the transformer, and that is the well known fact that heat conduction through iron is enormously more rapid than the rate at which heat is given off the iron surface to a fluid like oil. The consequence is that in the case of the iron of a transformer, unless that iron be of very large dimensions, there is little difficulty in bringing the heat from the internal portions of the iron to the surface, and when we consider again that the efficiency of a cooling system depends not only upon the contact with the hot body, here considered as the iron of the core, but also on the means for taking that heat away from the oil, we are led to conclude that since the greatest
553 difficulty which has been experienced in ordinary oil cooled transformers is in carrying the heat away from the case, there will be very little if any difficulty in taking the heat from the iron to the oil with sufficient rapidity so that the full efficiency of the case may be taken advantage of.

Shortly stated, therefore, I am of the opinion that although there will be in the larger sizes of transformers some advantage in separating the iron by means of vertical spaces through which by the gradient of temperature the oil will be made to circulate with moderate rapidity, there will be practically no advantage when these spaces are placed horizontally and of such thickness as the patent would call for.

Mr. BAKEWELL: In view of the answer of this witness complainant's counsel respectfully objects to the line of evidence contained in the same and statements made by the witness for the following reasons: While such testimony might have been material in the original cases, the case known as the "Carbide case" and referred to in paragraph 6 of the answer in this case, or in this particular suit in equity No. 4457, before the same was heard and determined by the Circuit Court, had the pleadings in the Carbide case or the pleadings in this case raised the issue of invalidity of Claim Four of the Westinghouse patent in suit, on the ground that the same did not disclose a useful invention, or the issue of non-infringement, upon the theory that what defendant did did not embody the invention of Claim Four, the record shows that no such issue was raised in this case. Furthermore, we have gotten clear beyond that point. The court having decided that Claim Four of this patent is for a new and useful invention, this decision having been rendered in the Carbide suit, and the defendant by its answer in this case admitting that it is bound by the matters and things found in the decree in that Carbide suit. The Circuit Court and Court of Appeals in the Carbide case as also this court by its decree in this case having found that Claim Four of the Westinghouse patent in suit is for a new and useful invention and having also found that the defendant has infringed the same, and having referred this case to the Master for the purpose of ascertaining what the complainant was entitled to recover from the defendant on account

of this infringement, it seems to me clear, particularly from the answer of this witness, that such testimony as given by this witness can not throw the slightest light upon any issue that must be determined by the Master upon this accounting, although it might have been relevant or material before the final hearing, on any issue which might have been raised as to the invalidity of the patent or its non-infringement by the defendant. Com-
554 plainant's counsel respectfully submits that the answer of this witness to that question should not be considered and should be stricken from the record as utterly irrelevant and immaterial to any issue before the Master.

Q. 151. Is or is not it necessary, essential, or indispensable to have an oil-cooled transformer provided with open spaces in its core, as set forth in Claim Four of the patent in suit?

Mr. BAKEWELL: I object to that question, may it please your Honor, not only for all the reasons I have stated in my objection to the former question and the answer, and there can be no question but what I am right in this. It is not a question of whether or not it is indispensable to have open spaces in the core in a particular type of transformer such as is claimed by Claim Four, in the sense that it may or may not be indispensable to make an operative transformer. It clearly is indispensable, in view of the language of the claim, that a transformer in order to respond to that claim must embody in its construction a combination of elements including such a transformer as shall be "constructed with open spaces in its core." The defendant is estopped from denying that such a transformer has been made and sold by the defendant. The fact is that the evidence shows that whether such an invention be useful or whether such an invention be of no value, the defendant has used it in large and small transformers, to the extent of thousands. Now I respectfully submit that it is utterly irrelevant, incompetent, and immaterial to this issue, in the face of the admissions of Mr. Layman, of the defendant company, in the face of the record which is before your Honor, for them to ask this particular question just put by defendant's counsel to this witness. It is indispensable under the terms of the claim that a transformer should have, among other things, "open spaces in its core"; and the admissions of the answer and the finding of the Court are, that the defendant has made and sold transformers which embody such a construction.

Mr. FOWLER: This question is not directed at all to the question of infringement, as your Honor may see, but it is directed solely to the question of whether the combination set forth by the Claim in suit is an indispensable one in a transformer, there being a line of cases holding that where certain patented features are indispensable in an apparatus, that the plaintiff is entitled to all the profits that the defendant has made; and there being other cases holding that where the features patented are not indispensable that

there can not be a recovery of all the profits due to the
555 apparatus. That is all this question is directed toward.

Mr. BAKEWELL: Counsel refers to a certain line of cases: I defy him to produce a single case which embodies the issues referred to in his question. The patented feature of Claim Four embodies an entire transformer made in a certain way, embodying certain elements and having certain characteristics. That particular transformer is admitted, and it is found by the Court that the defendant has made and sold and it is proven before your Honor that the defendant has made and sold, that particular form of transformer, to the extent of thousands. I submit it is not only reasonable to say the authorities abundantly support that, but under those facts it does not lie in the mouth of the defendant to deny the features of the structure which he has embodied. I ask that the question be read over again so he may see clearly that the question is objectionable.

Mr. FOWLER: If your Honor pleases I wish to take issue with counsel on statement that we have made a transformer which in its entirety is in strict accordance with Claim Four of the Westinghouse patent, because the record in this case shows that the transformers made by the defendant embody not only the combination of Claim Four, but that such transformers embody other features, to-wit, spaces between the coils and spaces between the coils and core. We have never made a transformer exactly in strict accord with Claim Four of the patent in suit and without containing any other features in it.

Mr. BAKEWELL: I am speaking of the record before the Master, and this is a mere quibbling of terms. The fact is, and the record shows, that the defendant admittedly, and in accordance with the findings of the court, has in fact used the invention of Claim Four. That invention may be varied in form. The Court in the Carbide case construed that invention. The defendant admitted it was bound by the findings in the Carbide case; and admits that it has made and sold transformers made in accordance with Claim Four. It is mere sophistry, especially in the light of the statements of Claim Four, which does not say one word about whether plates forming the core shall be arranged vertically or horizontally; but because, forsooth counsel now contends that defendant's transformer, in the absence of any proof in this record in regard to any but one particular transformer, that because defendant manufactures transformers with
plates arranged horizontally, and thereby has not made as
556 efficient a transformer as if it had followed the lines of the drawings of the patent. There is not a word in the patent which says the core plates shall be arranged vertically or horizontally.

Mr. FOWLER: I cannot see what all this is about. The question does not deal with spaces either vertical or horizontal, or anything of the kind. Judge Adams, in the case at bar, has made a specific ruling that this claim does not cover a transformer having open spaces between the coils and between the coil and the core. Now I have not in my question said anything about the spaces being vertical or horizontal and I am perfectly willing to admit that the

horizontal space is an infringement of the patent as well as a vertical space. The only point we have made in that question is, that a horizontal space is not as effective in cooling a transformer, and therefore the extent of profit or damages which the complainant is entitled to by reason of our arrangement should be mitigated in consequence thereof, because we have not gained the advantage to the great extent which the patent suit deals with, but only to a very minor extent.

The MASTER: Of course contesting the validity of the patent is entirely outside of the matter referred to the Master. The validity of the patent has been established and the infringement is admitted. To what extent the profits can be minimized, from the use of Claim Four, the Master is not able to foresee. It might be that from variations in construction the infringement in the use of Claim Four might be more or it might be less effective. It might possibly result in more or less profit, from the standpoint of the defendant, as I understand his position to be; being unable to determine whether the profit can be minimized in that way without hearing and weighing the evidence I am compelled to allow the question to be answered, subject to the objection, whether or not I can at present see the relevancy.

Complainant's counsel excepts to the ruling of the Master.

A. It is not necessary, essential, or indispensible that in an oil-cooled transformer there should be open spaces between the groups of core sheets, in order that the transformers may operate successfully. As a matter of fact, it is well understood and recognized, that for transformers of moderate sizes such spaces are entirely unnecessary. I know also, as a matter of personal knowledge, that a transformer of considerable size can be designed to operate successfully and efficiently, without such spaces. My opinion therefore is in the negative in regard to the question.

557 Mr. BAKEWELL: I object to this answer and especially to the latter part of this answer, which I presume your Honor must have noticed, where the witness now undertakes to state that he now knows of a transformer which may be made and will operate efficiently etc., without spacing strips. Even upon the theory of the defendant in this case, how can such a general statement as that be of the slightest assistance to your Honor. He does not say what type of transformer that is, whether or not it is a transformer which in other respects would be identical with the Westinghouse patent, but that it was discovered such a transformer would work efficiently without the spacing strips. The authorities are all one way in regard to that. If this answer were otherwise competent, such a general statement as that made by the witness can not be in the slightest degree relevant or of weight. Non constat from anything the witness has said that at the date of the Westinghouse invention it might be conceived to be of the greatest value to do what Westinghouse did. As a matter of fact the court did find it was a most valuable and useful invention, which neither the defendant nor your Honor can dispute at this stage, nor even this witness. Later

inventions might be made in relation to transformers and if subsequent to this transformer it could not be used in this case at all. So, in addition to the objections I have already made, I object particularly to the latter part of the answer of this witness where he makes this gratuitous statement which is general, indefinite, and absolutely misleading, so far as any issue before the Master is concerned.

The MASTER:

Q. I wish to ask Professor Gray whether in that last part of his remark he referred to advancement of the art of electrical manufacture since the date of the patent in suit, and does he refer to a well known and admitted principle, laying aside the question of the economy of production, that nothing is impossible.

A. The latter part of my answer referred to transformers as now manufactured. Transformers, however, were manufactured previous to the patent in suit, which had no air spaces and which operated successfully, and to as great a degree of economy as transformers manufactured by the inventor in question at that time. I do not refer to mere possibility but to the fact that actual transformers with efficient performance can be and are manufactured without such spaces between the sheets of the core.

Mr. BAKEWELL: I object to that testimony because under the principles of the patent office if a witness refers to trans-
558 formers made in England it would not affect this question at all; and so far as transformers manufactured in the United States, the witness is limited to the transformers in this case or must produce the particular transformer. It will not do to have the general statement of a witness produced by the defendant, to affect even the utility or the degree of utility of our invention by any such general statement as that.

Q. 152. Will you please refer to the specification of the patent in suit and quote what the specification says as to the group of plates of the core being separated and as to whether such construction is indispensable, necessary, or essential, or is preferable only.

Mr. BAKEWELL: I object to the question as utterly incompetent, irrelevant, and immaterial. The specification is only a part of the patent. The invention which is the subject matter of claim Four is the invention here at issue, the utility of which has been passed upon by the Court and admitted by the defendant in his answer, and the infringement is admitted; the very feature of opening up the core, having it constructed with open spaces in the core is one of the very things which was dwelt upon at length by the Circuit Court and the Court of Appeals and one of the things of value found by said Court and which said views of said Court defendant admits in its answer in this case it is bound by. Therefore I submit it is not the question now of what the witness may find in the specifications of this patent or how much stress may be made in the specifications of this patent as to the value and utility of such a construction.

The only question in this case is the extent to which the defendant manufactured and sold it.

In this connection I also wish to impress upon the mind of the Master that we are not here trying to recover from the user profits as such a measure of damages. Rightly or wrongly, the defendant believed that the transformer embodying in its construction Claim Four of the patent in suit was a useful device and one which he could make money by manufacturing and selling in the market, and he has made and sold such transformers, both large and small, as he admits, to the extent of thousands.

The MASTER: The answer is taken subject to the objection.

Counsel for complainant excepts to the ruling of the Master.

A. I find on referring to the patent referred to the following statement, beginning at line 56: "Each group of—say five or six—
559 plates thus applied is preferably separated from the succeeding group by air spaces. That is to say, there is a preference for the separation but my inference would be not a necessity for such separation.

Q. 153. Please refer to the pamphlet which I *how* hand you, and which has been marked "Defendant's Exhibit Pamphlet 'Aging of Transformer Iron' General Electric Company.

Mr. BAKEWELL: Complainant objects to that pamphlet and to any statements therein contained. I understand it is the same pamphlet offered in evidence yesterday in connection with Professor Nipher's testimony and I object to it on the ground that same is incompetent, irrelevant, and immaterial to any issues in this case, and also in view of the fact that from the date of the pamphlet it appears it was issued long after the date of the Westinghouse patent in suit and long after the infringement herein complained of.

The MASTER: The answer is admitted subject to the objection.

Counsel for complainant excepts to the ruling of the Master.

A. The pamphlet handed to me is one which was issued some time ago by the General Electric Company of Schenectady, New York. I am acquainted with the pamphlet, having previously examined it, and in a general way know the contents thereof. It is a pamphlet intended to give information in regard to the present knowledge of the subject of the aging of the transformer iron. I identify it as a pamphlet issued by that co[illegible]any.

Q. 154. Please state what is the cause of the aging of iron in transformers?

A. The cause of the aging of iron seems to be somewhat obscure. The only definite cause which we know of is that of continuous heating. Most of the investigations which have been made on this particular subject have vindicated that some change takes places during heating, particularly if that heating be at a sufficiently high temperature, which causes the iron to dissipate more energy during the period of continuous reversals of magnetizations. Whether heating is the sole cause or whether heating must always accompany such a change, is not definitely known. As a matter of fact, we know just about as little with regard to this question, as we

know with regard to the thing which it affects. The magnetization of iron is accompanied by the dissipation of energy. The property which causes iron to so dissipate energy has been given the name of hysteresis. What the mechanism through which this property acts is we know very little. The consequence is we
560 must speak very guardedly with regard to a definite statement as to what causes aging. We know one or two causes, and one of them we know is heat. We know we can produce it by heat. I believe we can produce it by other causes. We can produce it by heat, and that has been testified to by a number of authorities, if the heating be at a sufficiently high temperature. I may add, simply for the sake of clearness in regard to this matter, that the effect even of heating is varied, dependent on other conditions, the particular sample of iron, for instance. It is practically impossible to obtain two samples of iron which will behave in the same way. And, as an illustration I may recall the fact that the most important evidence of hysteresis which we know of is the existence of permanent magnetism in steel. The fact that steel can retain permanent magnetism is an evidence of the enormous retaining power and therefore of the enormous dissipative power of the material. If we take that material, however, or a material approximating to that and raise it for a considerable time from a moderately high temperature, we diminish the retentive power. Now that substance does not differ very materially from the substance with which we are dealing in transformers. It does differ, of course, but not very materially, and this part of my answer is simply given as an illustration of the difficulty of the subject, and not of anything directly bearing upon the question.

Q. 155. You have referred in your last answer to steel: To make this matter perfectly clear to the Master, will you please state whether the care of a transformer is made of iron or steel.

A. The common practice now, though not such a common practice at the date of this patent, is to make the sheets of what we call steel. I think probably, to be perfectly clear, I should explain something in regard to that. At the date of this patent, and some time previous thereto, the material which we used for making transformer cores would hardly have been called steel. I was in the habit myself, and a large number of others who had to deal with large quantities of that material, were in the habit of calling that material homogenous iron. It is a material which is practically pure iron, but it is made up by a steel process and has all the properties of steel as regards homogeneity. We now call it steel. And the only difference between that substance and the substance for permanent magnets is a small difference in the amount of carbon, mainly.

Q. 156. Are you able to state what is recognized as the temperature at which it is permissible to operate transformers in practice?

561 Mr. BAKEWELL: If your Honor pleases, I object to that question. That can not have anything to do with the invention here in question. It is only necessary for your Honor to read the specifications of the patent, if you have forgotten it. The matter

of aging of iron, or temperature, or anything of that kind, is not involved in this patent or at issue in this case. There may or may not be certain advantages attached to Claim Four that the patent does not refer to. But that can not be in question in this case. We are dealing here with a structure. The question here is whether the defendant has used a structure called for by the claim of the patent? If he has used it, and made profit by that, we are entitled to those profits. The inventor might have been entirely mistaken as to the advantages of the invention of the patent, but, notwithstanding the Court has found it extremely valuable. He might have been laboring under an hallucination in regard to the matter. Nevertheless the defendant used his invention and we are entitled to the profits he made by using that invention. We are going into very interesting matters of science but I think it is taking up the time of counsel and court unnecessarily and it seems to me can not be of the least help in deciding the issues that are here before the Master.

The MASTER: I am unable to see in advance what bearing this question can have upon the question of the amount of damages, but it may be made clear hereafter, and I will allow the question to be answered, subject to the objection.

Counsel for complainant excepts to the ruling of the Master.

A. The temperature at which a transformer may be safely operated is now recognized by such authorities as electrical societies, and the members of such societies, as in the neighborhood of 50 degrees Centigrade above the surrounding air. That would be 90 degrees Fahrenheit above the surrounding air. This, as will be readily seen, is not a definite temperature, because the surrounding air may vary considerably. There is a tacit understanding that average temperatures of say a distributing station will be the surrounding temperature and consequently that the transformers may be operated at temperatures ranging say between 70 degrees Centigrade to 85 to 90 degrees Centigrade (those temperature correspond to between 158 Fahrenheit [Fahrenheit] to 194 Fahrenheit), with perfect safety, as actual temperatures. Of course it is well to keep in mind here that the temperature at which a transformer can be safely operated will depend not only on the particular grade of steel which is used but also on the previous treatment of that steel. It is to be understood, therefore, that the transformer is to be constructed
562 of material recognized as good material for the purpose; such material as all well known manufacturers use.

Q. 157. In your opinion, would a rise of one or two or even five degrees in the temperature in a transformer cause the iron of such transformer to age to any great extent?

Mr. BAKEWELL: The question is objected to for the reason stated in the objection to the last question, and I also wish to call the Master's attention to the character of these questions. The witness is asked in regard to a transformer, etc. Now what counsel is after is simply beyond my comprehension. If after all these questions are not directed to the purpose of minimizing the claim for dam-

ages for use of the Westinghouse patent, they can not be for any purpose at all. And even on that theory, if such a question as that would be relevant, competent, and material, this question is not such a one. What type of transformer, what size, etc. Nothing of that kind is brought out.

Mr. FOWLER: In the redirect examination of Mr. Johannesen it is made to appear that if in the transformer there is a rise of temperature there will be a considerable aging of the iron. It matters not what kind of transformer it is certain aging goes on by reason of the heat. It may be a transformer made in accordance with claim Four, but it is simply a general question to show to what extent the temperature affects aging in a transformer, generally speaking. It does not make any difference whether it is air in there or oil or what it is, as long as the temperature goes up a certain amount of degrees there will be a certain amount of aging.

Mr. BAKEWELL: If the question was confined, as counsel now makes it, it certainly is objectionable for the reason stated. Suppose there is no importance in the aging of iron and admitting all that, for the sake of argument, the question of the aging of iron is not mentioned in the specification for the patent.

Mr. FOWLER: That is the whole purpose of the invention.

Mr. BAKEWELL: It is not mentioned and the defendant has used that invention.

Mr. FOWLER: Every invention has a purpose. The purpose of using the oil is for the purpose of cooling the iron and keeping it from deteriorating.

The MASTER: I will permit the question to be answered, subject to the objection.

Counsel for complainant excepts to the ruling.

563 A. The evidence of the experiments made by such men quoted by the General Electric Company, for instance, I will say Professor Goldsborough, who is a perfectly competent observer, is that a rise of temperature of one or two or even five degrees from the ordinary temperature of operation, would not, when a transformer is constructed of proper material, be at all important with regard to the aging of iron. The temperatures have to be considerably higher than this before there is a rapid change due to change of temperature. I believe therefore that limiting the change of temperature to that mentioned in the question, there would be no practical important difference produced by such a change.

Q. 158. Would a transformer constructed in accordance, mechanically and electrically, with Claim Four of the patent in suit, be provided with open spaces between coils and between the coils and the core.

Mr. BAKEWELL: Now, your Honor I think you begin to see the nature of this inquiry. I respectfully submit this examination should be stopped here. He is asking a question which has nothing whatever to do with anything before the Master. The only question before the Master is the extent to which the defendant has infringed this patent. Now he is going entirely outside this inquiry. Here

is Claim Four; the Court has construed it and the Court has said the defendant has manufactured and sold transformers in accordance with Claim Four. Now he is bringing in, by the language of his question, something that is not stated in Claim Four at all and has nothing to do with it. It would be precisely as relevant to this question if he should now ask this witness whether the moon is made of green cheese. I ask your Honor to weigh that question in relation to Claim Four.

Mr. FOWLER: Your Honor has several times during the hearing before you, both for the complainant and the defendant raised the question of whether the subject matter of Claim Four was definitely distinguishable from the rest of the patent in suit. Now this question simply asks the witness if transformers made in accordance with that claim, mechanically and electrically would be provided with, you may say, certain other features. It is directly relevant on the very question which your Honor has suggested several times in this case, and after considering the testimony of yesterday it occurred to me last night that this would be a question which would throw some light on the matters here inquired about.

564 Mr. BAKEWELL: There is only one issue here, and that is in regard to Claim Four. You can confine your question to Claim Four as much as you please, but you cannot go beyond Claim Four in the face of your distinct answer in this case admitting that the defendant has made and sold these transformers and the proof before the Master that they have made, manufactured, and sold them to the extent of thousands. In a certain sense you are asking this witness to construe Claim Four, but if not that, you are admittedly asking him something which has nothing to do with Claim Four.

Mr. FOWLER: I am not asking the witness to construe Claim Four, but am asking him to construe, mechanically and electrically, the question as based solely upon Claim Four and no other claim. It does not involve any other claim.

Mr. BAKEWELL: Your question does not mention Claim Four.

Mr. FOWLER: The witness has the patent before him with his finger on Claim Four.

The MASTER: I can not see the relevancy at present, but my ruling will be the same, that the witness many answer, subject to complainant's objection.

Counsel for complainant excepts to the ruling.

A. A transformer made in accordance with the description given in Claim Four calls only for spaces in the core. Without reference to the interpretation of the Claim, the core of a transformer is recognized in the art as being iron which is threaded through and around the coil. This is what is understood by electricians and electrical workmen when they are given directions as to construction, etc., with reference to the cores and coils. The core of a transformer is the iron part of it. The description here calls for spaces to be left in that core. It does not call for spaces elsewhere, and therefore I should say that a transformer constructed according to that claim

would not contain spaces between the coil or between the coils and the core.

My meaning is something like this: If I were in the position of directing a man to build a transformer and gave him such directions as are here given, and he made a transformer which had spaces in the core, and also had spaces [*had spaces*] surrounding the coils or between the coils, I should consider that he did not carry out my instructions; and that the apparatus which he so constructed was not the same which I had directed him to construct.

At this point recess was taken until two o'clock P. M.

After recess, on Thursday, October 26, the following proceedings were had:

565 Cross-examination.

By Mr. PAUL BAKEWELL:

X Q. 159. Professor Gray, please refer to the specification of the Westinghouse patent in suit, which was before you on your direct examination, and state whether or not it is true, that in that specification, after reference to the drawing between lines 22 and 25 on page 1, the specification proceeds to describe the invention the subject matter of the patent line 26, page 1, and line 85, page 1.

A. Referring to the patent in question, I find it is true that between line 26, page 1, and line 85 page 1 the specification describes the invention.

X Q. 160. Isn't it also true that in that part of the specification which proceeds to describe the invention, the subject matter of the patent, between line 26, page 1, and line 85, page 1, the specification writer seems to have repeatedly used the expression "preferably" or a corresponding expression such as "may be preferred:" For instance, isn't it true that in the second sentence of the paragraph beginning at line 26, page 1, and ending at line 40, page 1, he says: "The core is preferably composed of thin plates," etc.; that in the next sentence he says: "This insulating material is preferably applied," etc.; hat in the paragraph beginning at line 41, page 1, the specification states: "The plates are preferably constructed with two rectangular openings" etc.; that on page 1, lines 56, 7, etc., the specification states: "Each group of—say five or six—plates thus applied is preferably separated." Also that at line 65 page 1 of the specification, it states: "Preferably also the primary and secondary coils C^1 C^2 are separated from each other." Also that in the paragraph beginning at line 74, page 1 the specification states: "It may be preferred in some instances;" Don't you find repeated references in these specifications, as the specification writer has drawn it, to the words "preferably" or its equivalent "may be preferred?"

A. The statement in the question is correct in regard to the frequent use of this term "preferably", or its equivalent. I find, however, that the meaning in these different cases are similar to the one which I referred to in my direct examination; that is to say, it carries out the idea that the construction there referred to is not a

necessary construction; that that particular part might be omitted; "The plate is preferably composed of thin plates of soft iron", would lead one to believe it might be composed of something else. "The insulating material is preferably applied to one surface of the plates", etc." means that it may be applied to one surface of the plates, and may not; it might be applied to both surfaces,
566 for instance, or perhaps in other ways. And so on with the other references. Reasoning in the same manner, when we come to the quotation which I made, we might make a direct interpretation, namely "Each group of—say five or six—plates thus applied is preferably separated from the succeeding group by air spaces", that the transformer might be built up without these air spaces.

Mr. BAKEWELL: Your Honor must have observed in the answer of the witness that he has gratuitously made statements not concerned with the question at all. I am not concerned with his making an argument on this record. I have simply asked this witness a question of fact; and I ask now that all of the answer of the witness, except that directly responsive to the question, be not considered by the Master at all in this inquiry.

X Q. 161. Now confining my question to its terms, please answer directly whether or not I quoted correctly from the specification?

The MASTER: That is a question which calls for a direct answer, yes. or no*t*.

A. The quotations are perfectly correct.

X Q. 162. Do you mean to give it as your opinion that because a certain element or feature is referred to in the specifications, especially in the specifications of this patent, as an element or condition that may be preferably used, it follows, therefore, such part is not an essential part of the invention, irrespective of the fact that such part is claimed in the claim as an essential part of the invention?

Mr. FOWLER: I submit that is a question of patent law, pure and simple.

The MASTER: I think it is calling for the opinion of the expert, to define his meaning.

A. In my opinion, when a man states in his specification that a thing may be preferably done in a certain way, he means that this is one of several ways it may be done; and, therefore, that that particular way of doing the thing is not essential.

X Q. 163. Is that your answer to my question?

A. Yes, sir.

X Q. 164. Was my question confined to the abstract, or was it not specifically made with reference to these particular specifications in this particular patent?

A. My answer refers to any patent, this included.

567 X Q. 165. It is your opinion, then, that notwithstanding the fact that claim 4 of the patent defines the specific combination in which one of the elements or conditions is, that the con-

verter shall be constructed with open spaces in its core, nevertheless that is an immaterial part of the invention?

A. I do not mean that by my answer. I consider that when a man claims a particular feature in one of his claims, that he wishes to obtain the sole right to use that particular feature. My reference was to the specification, that when a man says he may do a thing preferably in a certain way, that doing the thing in that certain way is not essential. If he claims a particular way of doing the thing, or a particular form, then he means that so far as that claim is concerned, that is an essential part.

X Q. 166. In your quotation from the patent this morning, you did not pretend to quote all that the specifications states as to the means stated or suggested by the patentee, by which the converter may be constructed with open spaces in its core, did you?

A. I did not. I only quote- what I thought absolutely called for by the question.

X Q. 167. As a matter of fact, the specification on that point, that is to say, the point of constructing a converter with open spaces in its core, says as follows; does it not? "Each group of—say five or six—plates thus applied is preferably separated from the succeeding group by air spaces. These may be produced by passing tubes f^1 f^1, which may be of soft iron or other metal, or of vulcanized fiber, along the length of the plates. It may be sufficient in other instances to block the group of plates apart at intervals instead of extending the tubes the entire length."

A. That quotation is correct.

X Q. 168. Did you ever have occasion to read the opinion of the court, rendered with respect to claim Four thereof, which was rendered in the case of the Westinghouse Electric & Manufacturing Company vs. The Union Carbide Company, reported in the 112 Federal Reporter between pages 417 and 423 thereof, especially that part of the opinion of the court found at page 423 of the Federal Reporter above referred to, in which the court specifically refers to the contention of the complainant on one of these very points referred to by you on your direct examination, in these words: "The Westinghouse patent stated that the plates are preferably separated and that it may be preferred in some instances to surround the transformer with oil or parafine, or other suitable material. It is stated by the patent that 'The converter or transformer may be sealed in an enclosing case which may or may not contain a non-conducting fluid or gas.' It is insisted that these are matters of recom-
568 mendation or preference, only, and do not constitute essential features of the patent; but this, however, must be read with Claim Four of the patent. It is quite true that a feature which is mentioned only by way of recommendation in describing an invention, must usually be considered as a subordinate and not an essential part of the patent. But the claim upon which complainant relies still clearly indicates the intention of the patentee to claim as essential the features described by the specification as preferably employed." I ask if your attention has been called to that opinion, and that quotation which I have read?

A. My attention has not been called to the opinion referred to, and I do not remember having read it.

At this point the further hearing of testimony was adjourned by the Master to Thursday, November 9, 1905, at ten o'clock in the forenoon.

Met pursuant to adjournment as above on Thursday, November 9, 1905, at ten o'clock A. M., at the office of Messrs. Fowler & Bryson, in the Commonwealth Trust Building, St. Louis, Missouri.

Present: Mr. Paul Bakewell, representing the complainant; Mr. A. C. Fowler, representing the defendant; Mr. H. H. Denison, Special Master; when the following proceedings were had:

GEORGE E. WELLS, a witness of lawful age, being duly produced, sworn and examined, on the part of the defendant, testified as follows:

Direct examination.

By Mr. A. C. FOWLER:

Q. 169. Are you the George E. Wells who previously testified in this case, and whose testimony is found in the printed record beginning at Page 69 and continuing to Page 75?

A. I am.

Q. 170. What is your present occupation, Mr. Wells?

A. Consulting engineer.

Q. 171. Were you ever employed by the Wagner Electric & Manufacturing Company, and if so, when and in what capacity?

A. I was employed by the Wagner Electric & Manufacturing Company from September, 1898, to July, 1901, in the capacity of engineer for the company.

Q. 172. What were your duties, specifically, when connected with that company?

A. The designing of switch-boards and transformers; superintending the erection of switch-boards and transformers; and other engineering duties along those lines.

569 Q. 173. After the decision of the Court of Appeals sustaining Claim Four of the patent in suit, did you have occasion to make any changes in the Wagner Electric & Manufacturing Company's transformers used by the Union Carbide Company; and if so, what changes did you make in that apparatus?

Mr. BAKEWELL: Objected to as utterly irrelevant to any issues in this case. We are not concerned here with what changes, if any, the defendant may have made in a certain transformer which was found to infringe the patent. I do not see how that could possibly be relevant or material to any issue in this controversy.

The MASTER: That is something in which some change has been made since the judgment?

Mr. FOWLER: Since the judgment in the Union Carbide case.

purpose of this question is simply to show what the effect is having these open spaces in the core of the transformers.

The MASTER: I think it is immaterial to these issues here, but question may be answered subject to the objection.

A. I do not know the date of the decision you refer to.

Q. 175. The decision was April 29, 1902.

A. I did make changes of transformers after April 29, 1902. e object of these changes was to remove the spaces in the core of transformers of the Union Carbide Company.

Q. 176. Please look at the cut shown on Page 168 of the printed ord in this case, and state whether that is a cut or drawing showing the construction of transformers in which you removed the open ces in the core

Mr. BAKEWELL: I object to that question for the reason stated in last objection. It is utterly irrelevant and immaterial to any ues in this accounting, where the defendant is accounting for nsformers made and sold by the defendant, which it is admitted fringed Claim Four of the Westinghouse patent in suit, what anges were made, if any changes were made, in the transformers fore the Court in the Carbide suit.

Mr. FOWLER: The transformers involved in this case, and we ppose to show, the purpose of this question and the testimony of s witness, is to show the extent of the usefulness of the open ces in the core, or the subject matter of Claim Four of the patent suit, and that we propose to show the extent to which this improvement has contributed to the success of the transformer.

0 Now it seems to me the testimony is extremely relevant. The claim here is that these open spaces in the core are ry important and controlling improvements, and when we attempt introduce any evidence to minimize that, the objection is made at it is irrelevant and immaterial. These very Union Carbide nsformers are listed in Mr. Layman's schedules here, taken from e books of the Wagner Electric & Manufacturing Company. he transformer shown in this cut is the transformer which the ecree in this case runs against. Now we show that by making certain changes, and by taking out the open spaces in the core, we ant to show what that transformer will do; whether it operates orse or better.

Mr. BAKEWELL: I would like to make record of an objection ere, and afterwards I can simply refer to it briefly. With permission of the Master, I should like to do that.

The MASTER: You may do so, but before you do that perhaps would better state my ruling here.

Of course, I cannot anticipate exactly how far this testimony may e relevant in the matter of litigation for damages. I see that ossibly it might be very relevant on the theory of the defendant, nd it might be wholly irrelevant on the theory of the complainant. he witness may answer the question subject to the objection.

The counsel for complainant may state his objection.

Mr. BAKEWELL: In the first place, may it please your Honor, it

is only necessary to refer to Claim Four of the patent to see that defendant's counsel is utterly mistaken in his apprehension of what the invention in controversy is. Counsel iterates and reiterates words to the effect that the invention, the subject matter of Claim Four, relates only to the open spaces in the core, as if we have a patent on the open spaces in the core; whereas it is only necessary to look at Claim Four to see that the invention, the subject matter of Claim Four, is an entirety. It is true that one of the conditions is open spaces in the core. It is specified in that claim that the converter, among other things, shall be constructed with open spaces in its core. Now the admitted facts on this record are, that the defendant has used and manufactured and sold transformers embodying in their construction the invention, the subject matter of Claim Four, that defendant has done this to the extent of thousands of transformers.

Now this attempt on the part of the defendant, after all, in its first analysis of the thing, and its last analysis, is simply and
571 solely for the purpose of showing want of utility in that invention.

I contend it is impossible for the defendant, who has admittedly infringed this patent and Claim Four thereof, to deny the utility of that invention.

In the case of Lehnbeuter vs. Holthaus 105 U. S. 96, the Supreme Court holds that the fact that a defendant has infringed the patent is sufficient to establish its utility. This doctrine is confirmed by the Supreme Court in the case of Gandy vs. The Maine Belting Company, 143 U. S. 595-96, and the case of Goss Printing Press Company vs. Scott, 108 Fed. Rep. 258, in these words:

"The fact that a patent has been infringed by a defendant is as against such infringment sufficient to establish its utility." It does not throw any light on the ultimate question before the Master, even if it be a fact which should be shown by the defendant, to show that this infringment which the defendant has admittedly carried on to the extent of manufacturing and selling thousands of infringing transformers, was in respect to a structure which is not useful. Now, to permit the defendant to take this line of testimony, is to enable the defendant to escape that very estoppel which operates upon him by virtue of the fact that he has used the invention, the subject matter of Claim Four. The Defendant has used it, has sold it, and has sold these transformers, and has made profit out of it. That being true, it does not seem to me that it is possible for this defendant to take testimony before the Master to show want of utility in that invention. The utility of the invention having been affirmed by the Circuit Court of Appeals in the Carbide case, by the decree of the Court in this case, granting the injunction and by the admissions of the defendant's answer that he is bound by the decisions and findings in the Carbide case.

With the Master's permission, having made this full objection on the record, I would like to be understood as repeating this objection to all of the questions that may be asked of the witness, without specifically making the objection to each question, with the under-

standing that should the Master see fit to overrule the objections, my exceptions will be preserved.

The MASTER: That may be so entered.

But while the infringement is admitted, while the utility is consequently, if not confessed, adjudged, I am not able at this time, and at this stage of the hearing, to pronounce that the defendant may not, in mitigation, show, if it can, that there may be different degrees of utility, that it may be complete or it may be partial. I am

572 unable to pass upon that question at present; and the only thing I can do is to allow this testimony to be taken subject to the objection of counsel for complainant, and wholly unable to indicate what my ruling will ultimately be upon the matter.

Mr. FOWLER: I should like to make a statement so the Master may understand my position in using this expression, "a transformer with open spaces in its coil." That is merely a succinct way in which I have referred to Claim Four of the patent in suit, and when that expression is used by me it implies that such transformer is an oil cooled transformer, that it has, in addition to the open spaces in its core, an enclosing case and a non-conducting fluid or gas in said case, adapted to circulate through said spaces and about the converter. I have thought it unnecessary every time in putting a question to the witness to read the combination specified in this claim.

But the fact is, that these Union Carbide transformers were oil cooled transformers, and oil was contained in the case, and there were spaces in the core of the converter, and the oil was adapted to circulate through the spaces. To what extent the circulation took place through these spaces may be shown by the testimony.

If the Master wishes me in questioning the witness to specify each time the combination *as* specified in the claim, I am perfectly willing to do so, but I am simply using that expression to shorten the record. With that understanding, I will put the questions in that way. I have no contention here that this patent merely covers open spaces in a converter. I admit the claim does not cover that with air, but I simply referred to it *in* an oil cooled transformer. That is the only thing we are speaking of in this case. It is merely a succinct way of referring to that feature.

The MASTER: When you refer to a transformer "having open spaces in the core" you wish to be understood as referring to a transformer having all the features of Claim Four?

Mr. FOWLER: All the way through this whole record I have so used it. We are speaking here in this case of oil cooled transformers, and the Court of Appeals limited this patent to oil cooled transformers; and the same in the case at bar. Of course, I can go on each time and specify this combination and refer to oil cooled transformers. But when the only transformer here is an oil cooled transformer, when I speak of a transformer with open spaces in the core, it necessarily refers only to such transformers as are involved in this case, to-wit, oil cooled transformers.

573 A. I recognize the cut. The same is a transformer in which the spaces in the core were removed.

Q. 177. Was that transformer an oil cooled transformer? In other words, did it have a casing in which was contained oil?

A. It was an oil cooled transformer.

Q. 178. Will you please state at whose instance you made these changes that were made in these Wagner Electric & Manufacturing Company's transformers used by the Carbide Company, and what was the purpose in making these changes?

A. The changes were ordered made by the Wagner Electric & Manufacturing Company. The purpose of the changes was to remove the spaces in the iron core.

Q. 179. Where were you employed when you made those changes? Or, in what business were you engaged?

A. I was a partner in the firm of Ruebel & Wells.

Q. 180. Will you please state exactly what you did in making these changes, and removing these spaces, and state for what purpose?

A. There were three transformers to be so changed under my supervision. In the first transformer the change was made at Niagara Falls, the transformer being reconstructed. New coils were sent on to Niagara Falls, and the same core was used, but in building up the transformer no spaces were provided in the iron core.

Q. 181. My last question asked you to state the object in removing the spaces from the core: will you please state it?

The MASTER: I think the witness should be first asked whether he knew the object, because that is a matter of opinion otherwise.

Q. 182. Are you able to state what was the object of removing the spaces in the core?

A. I was informed at the time that the object was to—that the reason for this change was on account of patent litigation. I did not know definitely just the details of the case.

Q. 183. Did you make any tests on these transformers with open spaces in the core, and without open spaces in the core?

A. I did make tests on these transformers.

Q. 184. Will you please state what you did, and what was the result of your tests on these transformers?

A. In June, 1902, I went to Niagara Falls and connected up these transformers so as to make a complete temperature test on one of the transformers, both with the spaces in the iron core, and a similar test after spaces were removed from the iron core. The result of this test shows that there was no appreciable difference in the rise in temperature of the transformer when same were operating with spaces in the core and without spaces in the core.

574 Q. 185. What do you mean by "appreciable difference in the rise of temperature"?

A. In this case we call one degree Centigrade an appreciable rise.

Q. 186. Mr. Wells, won't you please state so the Master may understand this matter, just exactly what you did and how you conducted these experiments?

A. I took two of the transformers, using one as an auxiliary in the test, and connected them up, independent of everything else on the system. I had it arranged so I could keep the quantity of current in the transformers as nearly equal all the time as it was possible to

do, and regulated everything in the two tests so that I could repeat the same conditions after the spaces were removed from the core, just as nearly as it was possible to do. Careful readings were taken on the first test, in which the maximum temperature of the transformer tested was secured, both in the coils and of the oil. The temperature of the oil being read by thermometer. The transformer was operated continuously over a great number of hours in order to obtain the maximum temperature.

After this test had been made, the transformers were allowed to cool, the current was disconnected, so as to allow the transformer to cool. The transformer was taken down and the same iron was left on the core, and the spacing blocks were removed. After this had been done, the transformers were connected in the same manner, with the same instruments in the circuit, and the previous conditions, or the conditions of the first test, were duplicated just as nearly as I could possibly do it; and then the same test was repeated, in order to get the maximum rise in temperature under the second condition.

There were four tests made, of this kind, two with the spacing blocks in position, and two with the spacing blocks removed.

By the MASTER:

Q. 187. These experiments were in all cases with the same strength of current and of the same length of time?

A. Yes sir, the same length of time and the same current, as nearly as it was possible to keep it. Any variation we noted in our records.

Q. 188. You say you made four experiments: what was your object in making four experiments?

A. Two to check the first two.

Q. 189. Please state again, what, if any, rise in temperature you found to exist, or difference of rise in temperature you found to exist, in the two different cases?

575 A. The rise in temperature, with the spacing strips in position, and with the spacing strips removed, was practically the same in both cases.

Q. 190. Did these transformers which you tested, and which were at the Union Carbide works, also have open spaces between the coils, and between the coils and the core?

A. They did.

Q. 191. Then, as I understand it, the only change which you made in these transformers in testing them, was to remove the open spaces in the core: is that right?

A. That is right. That was the only change.

Counsel for complainant states that he does not desire to cross-examine this witness, relying upon the objection that he has already made to the testimony; but desires to call the Master's attention again to the effect of this line of examination, and to the fact that it is utterly irrelevant and immaterial to any issue in this case. It is a proposition of law concerning which there can be no dispute, that infringement of a patent involves substantial identiy.

It is said by Robinson on Patents, Vol. 3, Secs. 891-2: "The invention whose manufacture, use or sale constitutes an infringement of the patent, is the invention covered and protected by the patent." It is also said by the same author, in Vol. 3, Secs. 893-4: "It is elementary that infringment resides in substantial identity."

Complainant's counsel desires to call the attention of the Master to the records in this case, to the fact that the Court in this very Carbide case, in relation to the particular transformer referred to by the witness, holds that this transformer as illustrated on page 168 of the printed record before the Circuit Court in this case, infringed Claim Four of the Westinghouse patent in suit. Not only this, but the Circuit Court and the Circuit Court of Appeals, in the Carbide case, both held, as a matter of fact, that there was not only utility but that there was great utility in the invention the subject matter of Claim Four of the patent in suit; and that the Union Carbide transformer illustrated at Page 168 of the printed record before the Circuit Court in this case embodied in its construction the invention of Claim Four.

Now, the defendant in this case by its Answer, to which I have repeatedly referred in my objections, admits by Paragraph 8 of that Answer that it is bound by the things found in the decree of the Court in the Carbide case.

Now, if the witness is correct in his statements here made, and infringement involving as it must substantial identity, then it must follow, as an irresistable conclusion, that there is absolutely
576 no utility, according to defendant's present theory, in the invention which is the subject matter of Claim Four of this patent.

Thus it must be seen, that under the guise of introducing proof in mitigation of damages or profits, this defendant is in effect undertaking to over-rule the decisions of the Circuit Court and Circuit Court of Appeals in the Carbide case, by which it admits it is bound; and over-rules the standard principles of law to which I have already called your Honor's attention, that where it has been found that the defendant has infringed a patent, the defendant is estopped from denying the utility of the invention which it has infringed.

I simply desire to emphasize the position which I take, as I believe, for the convenience of the Master, and with the statement, that calling the Master's attention to my position on the record, I respectfully decline to cross-examine this witness.

ALEXANDER S. LANGSDORF a witness of lawful age, being duly produced, sworn and examined, in behalf of the defendant, testified as follows:

Direct examination.

By Mr. A. C. FOWLER:

Q. 192. Please state your name, age, residence and occupation?
A. My name is Alexander S. Langsdorf. I am twenty-eight years old, a resident of the City of St. Louis. My occupation is professor of electrical engineering at Washington University.

Q. 193. Please state whether or not you had occasion to make any tests on oil cooled transformers for the Wagner Electric & Manufacturing Company, the defendant herein, and if so, state when.

Mr. BAKEWELL: I object to that question, may it please your Honor, upon the ground that it does not appear that the question is even remotely connected with this case. If the question is intended to apply to transformers of the construction called for by Claim Four of the patent in suit, and if that question is for the purpose of showing, or undertaking to show, want of merit or utility in such a structure, then I object to this question for all of the reasons stated in my various objections to the testimony of the witness Wells who has just left the stand.

And, with the Master's permission, having stated these objections very fully on the record, in connection with the testimony of Mr. Wells, I should like to have those objections considered as made to the testimony of this witness.

Unless this question is confined to transformers embodying in their construction the invention the subject matter of Claim
577 Four of the patent in suit, I object to it specifically on the ground that it is too general and vague, and utterly irrelevant and immaterial to any issue in the case.

The MASTER: The witness may answer the question, subject to all the objections as stated by counsel for complainant.

A. I have made the tests on two transformers at the factory of the Wagner Electric Manufacturing Company; the tests having been begun on Wednesday evening, November 1st, and conducted for twenty-four hours thereafter.

The transformers were each of 15 kilowatts capacity, with a transformation of 2200 to 2220 volts and were of the oil cooled types. They were also of sixty cycles. One of the transformers was built with open spaces in the core, two open spaces, each about five-eighths of an inch wide. The other transformer was built with its laminated core solid.

The results of the tests showed that the temperature rise was in each practically the same. By this I mean that the difference in temperature between the two transformers at the end of the twenty-four hours' run at full load, was not more then one and one-tenth degrees Centigrade.

The procedure in making the test was along the standard lines, the temperatures of the oil, the core and the surrounding air, having been read and recorded every half hour during the period of the run. At intervals throughout the run the temperature was also measured by the drop or potential method. The results of the tests were incorporated in the report submitted to the Wagner Electric & Manufacturing Company, and were substantially as described.

Q. 194. In your last answer you have referred to a difference of temperature amounting to one and one-tenth degree Centigrade. By this I understand that one of these transformers which you tested ran one and one-tenth degrees Centigrade hotter than the other. Am I right in this?

A. Yes sir, that is correct.

Q. 195. Which transformer ran the hotter, or gave this rise of one and one-tenth degrees centigrade: the one with open spaces in the core or the one without open spaces in the core?

A. The one with spaces in the core was one and one-tenth degrees centigrade hotter than the one without spaces—wait a moment, I may be wrong about that. No sir, it was the other way around: the one without spaces was one and one-tenth degree centigrade hotter than the one with spaces. That was the temperature of the oil, to which that figure refers.

By the MASTER:

Q. 196. What would that be Fahrenheit?

578 A. Multiply one and one-tenth by one and eight-tenths, that gives 1.98, or practically two degrees Fahrenheit.

By Mr. FOWLER:

Q. 197. (Resuming:) Please look at the transformers which I now show you, and state if you recognize the same, and what they are?

A. This (indicating Transformer No. 1) is the transformer which was tested. This is the one with spaces in the core. And this (indicating Transformer No. 2) is the one without spaces in the core. These are, at any rate, similar to those which we tested. They are the same size.

Q. 198. How about the construction?

A. These transformers are identical in all respects with those which we tested.

Q. 199. But you are not able to state whether or not they are the same transformers?

A. I am not able to state positively that this is identically the same transformer as tested, because when tested the marks by which they were identified were made upon the case.

Counsel for defendant offers in evidence the transformers referred to by the witness, and asks that the same be marked "Defendant's Exhibit, Transformer No. 1, with Open Spaces in the core", and "Defendant's Exhibit Transformer No. 2, Solid Core".

Objected to by counsel for complainant as irrelevant and immaterial for the reason stated in the objections first made to the testimony of this witness, and for reasons more fully spread upon the record in connection with the testimony of the witness Wells.

Q. 200. Please refer now to the two transformer cases to which I call your attention, and state if you recognize those transformer cases, and what they are?

A. These are the two cases which were used in the test and there is a further identification on them, of two cold chisel marks, directly under the cover in each case. I will have to lift them off in order to show that.

(Witness here removes covers.)

This (indicating) was the case [if] the transformer that was called Number Three" during the test. That was the one that contained he core without spacing blocks.

Witness here refers to an enclosing case.)

This case containing two cold chisel marks, is the one that contained the core with the spacing blocks.

I wish to state further that at the end of the run the oil
579 was drained from both cases, and the cores were removed, for the purpose of ascertaining definitely whether the cores vere as represented. It was found that the case marked "II" contained a core which was built with open spaces; and that the case narked "III" contained a core which was built up solid.

Counsel for defendant asks that the transformer cases referred o by the witness be marked for identification, "Defendant's Transformer Case No. 1," and "Defendant's Transformer Case, No. 2." Same are objected by counsel for complainant for the reasons stated in the objection to the introduction in evidence of the transformers, which are claimed to have been used in this case.

Q. 201. Please state whether these transformers which you tested had open spaces between the coils and between the coils and the core for the circulation of oil?

Objected to by counsel for complainant as immaterial.

The MASTER: The witness may answer subject to the objection.

A. Yes sir.

Q. 202. What rise of temperature would cause a noticeable aging of iron in a transformer over and above the temperature which is common at normal working temperatures?

A. The rise of temperature of approximately thirty degrees more than that which is permissible in transformers under full load conditions would produce an appreciable increase in the aging effect of the iron. But it is not probable, from the effects of tests which have been made, that a rise much less than this would produce an appreciable difference in the aging of the iron.

Q. 203. What authority have you for your statement?

A. The authority is based on an article which appeared in a series of articles on the subject of electric generators, by Messrs. Parshall & Hobart, in "Engineering," a magazine published in London, the publication appearing in Volume 65 at Page 99 of this magazine, under date of January 28, 1898.

Quoting from this article, on page 100——

Mr. BAKEWELL: Before the witness quotes from this article referred to, I object to this, not only for the reasons stated in the objection I have already made, but also for the further reason that it is utterly irrelevant and immaterial to any issue in this
580 case, since the alleged publication to which the witness undertakes now to refer is more than eleven years after the date of the Westinghouse patent in suit, and the statements contained in that article are in no way binding upon the complainant.

In no other way can they be relevant or material to the issues in this case.

The MASTER: The witness may answer subject to the objection.

A. I quote as follows, "From these investigations it appears that iron can be obtained which will not deteriorate at sixty degrees centigrade, but that some irons deteriorate rapidly even at this temperature, and that at the temperature of ninety degrees centigrade even the more stable brands of iron deteriorate gradually. Consequently, as far as relates to avoiding of deterioration through aging, apparatus, even when constructed with selected irons, should not be allowed to reach a temperature much above sixty degrees centigrade."

Now the standard rules of the American Institute of Electrical Engineers specified that a temperature not exceeding forty degrees above that of the surrounding air should be allowed in transformers, in those parts of transformers which can be measured by a thermometer. This means that the normal working temperature at full load of these parts will be in the neighborhood of sixty to sixty-five degrees, assuming an air temperature of from twenty to twenty-five degrees, all centigrade. Therefore, this noticeable deterioration will not occur until a rise of thirty degrees greater than this amount has been reached.

The answer is objected to by counsel for complainant on the ground that the rules established by the American Institute of Electrical Engineers is in no way binding upon the complainant in this case; and, furthermore, the witness does not undertake to state when that rule was established.

A. I can give the date at which that was adopted. (After consulting book) This rule of the American Institute of Electrical Engineers referred to was adopted in 1898 by the American Institute of Electrical Engineers upon recommendation of a committee whose names are signed to that report. The report is printed in revised form in Volume 19 of the transactions of the American Institute of Electrical Engineers. I cannot give you the page number, but I can give you a reference to the reprint of that in another book.

Q. 204. Please state whether you agree with the state-
581 ments made in the volume of "Engineering" which you quoted in your last answer?

A. I fully agree with them, because they are based upon reports made by men who are eminently qualified to carry on such investigations.

Q. 205. To what extent do horizontal open spaces in the core of oil cooled transformers contribute, in your opinion, to the efficiency or success of such transformers?

Mr. BAKEWELL: May it please your Honor, I object to this question as grossly irrelevant and immaterial to any issue in this case. The question is confined to horizontal open spaces in the core. There is not a word said in the specification or claim of the West-

inghouse patent in suit, or in Claim Four thereof, as to the spaces in the core being horizontal or vertical. On the contrary, the claim was purposely broadly drawn so as to cover spaces both vertical or horizontal.

In addition to this, I wish to call your attention to the fact that the substantial identity of the infringing transformer of the defendant with the transformer of the patent, especially the transformer covered by Claim Four thereof, has been established; not only established by the decisions of the courts in the Carbide case, but by the decree of the Court in this case, and by the express admissions of the defendant's answer.

I also wish, in addition to the objections which I here make, and to the objections which I made to the testimony of the witness Wells, which your Honor permitted me to apply to the testimony of this witness, to add that even if this were to develop in this case that in the use of Defendant's invention, the subject matter of Claim Four, the defendant had unintentionally or accidentally, made a structure which imperfectly carried out the invention of the patent, nevertheless, under the decisions, that would be an infringement. I regard this point as so clear, and yet so important, for the defendant to undertake to show defendant's transformer ever embodied the invention of Claim Four, although not having all the advantages of the invention, that I would like to read to the Court, in connection with my objection, the decision of the Court in the case of White vs. Peerless Manufacturing Company, 111 Fed. Rep. 192, where the Court reviews the decision on this very question, including the case of Sewall vs. Jones, 191 U. S. page 171. The Courts there held that where the respondent is an infringer, and where he prepares an invention so as to gain, even imperfectly, or to a limited extent, the advantages that may be derived therefrom, he does not thereby free himself from infringement and from liability to the complainant.

Now having made this objection I would like your Honor
582 to notice the form of this question, and the terms of the specification of patent and of Claim Four, and see how immaterial and irrelevant that question must be to any issue before the Master.

Mr. FOWLER: We are not here dealing with the question of infringement. There has been no proof in this case of any transformer having been made by the defendant, other than a transformer having horizontal spaces in the core. Now, it may be that such transformer is an infringement of the patent. The question is, to what extent do these horizontal spaces contribute to the efficiency of the transformer, or to what extent has the utility of the patent in suit been employed by the defendant. Not that it has not been employed at all, which deals with the question of infringement, but to what extent has it been employed. If it carries out very imperfectly, and to a very minor extent, the purposes of the patent in suit, then it seems to me obvious that the complainant is not entitled to as large an award of profits and damages as if the apparatus had been constructed by the defendant to carry out the

full purpose of the invention. It is very true that the patent in suit does not say that these spaces in the patentee's transformer are vertical, but they are shown to be vertical in the drawings of the patent in suit. Now, we make a form of transformer in which we use horizontal spaces. Now, to what extent does that embody the usefulness of this invention? This is the question, and we think we have a right to show that.

Mr. BAKEWELL: The gentleman is mistaken in regard to his fact, and mistaken in his conclusion of law, from the admissions of the record in this case. Here is the answer of the defendant, and at paragraph nine thereof, on page 13 of the printed record before the Circuit Court, we find the following: "And this defendant admits that it has, since the 12th day of July, 1887, and subsequent to the assignment to the complainant, within the Eastern District of Missouri, and elsewhere throughout the United States, made, used and sold devices or apparatus which embodied the invention or discovery claimed in Claim Four of these letters patent."

Now, may it please your Honor, when we put Mr. Layman on the stand I asked Mr. Layman in reference to Claim Four of this patent, and your Honor will remember that distinctly, to give the account of transformers made and sold by the Wagner Electric & Manufacturing Company during the period of time covered by the accounting, which embodied in their construction the thing claimed by Claim Four of the Westinghouse patent. We then had a statement from Mr. Layman as to the number of such transformers, but not a word said by Mr. Layman as to whether those
583 transformers were arranged with the spaces vertical or horizontal. And defendant, although he had opportunity to do so, did not even cross-examine Mr. Layman. So much for the statement of the gentleman that the only proof in regard to the infringement is in regard to the transformers being arranged with open spaces in their core, arranged horizontally.

Now, may it please your Honor, I emphasize that point, but I further state that the fact that the patent illustrates one form of transformer is in no wise binding upon the complainant. That has been well settled by the decision. The drawing of the patent is simply made in conventional form. Under the statute it is necessary for the inventor to show only one form of the embodiment of his invention, and that the patentee has done. But the claim is what controls it.

Furthermore, in respect to a transformer with the spaces in its core arranged horizontally, which I admit was the form of transformer illustrated and before the Court in the Carbide case, what does the Court there say? The Court finds that is an infringement of the patent, thereby declaring in law that that is substantially the identical thing called for by Claim Four.

Now, under that state of facts, may it please your Honor, it is utterly immaterial to this inquiry whether or not transformers which have been accounted for by the defendant in this case, and which, by the way, have not been proved to be transformers arranged with the spaces in the core horizontal—I say it is utterly immaterial

whether or not, as a matter of fact, those transformers were arranged so that the open spaces in the core are in a horizontal position. That is utterly immaterial. But it has not been proved to be a fact in this case.

Furthermore, on the line of my same objection, I respectfully submit that if it had been proved as a fact in this case that the defendant's infringing transformers were arranged so that the open spaces in the core were in a horizontal plane, that that would not affect this question one iota. Under that very line of decisions to which I called your attention, under the decisions of the Supreme Court of the United States, it is utterly immaterial whether or not the defendant had seen fit to intentionally or accidentally use the invention of the patent so as to accomplish imperfectly the purpose of the patent. I do not admit that if the spaces in the core were arranged horizontally, that accomplishes the purpose of the patent properly. But if it were true, it would be utterly immaterial,
584 and would not affect the complainant in this case. In contemplation of law, here is a complainant with a patent, on a new and valuable invention. The Court has so found it. The defendant has infringed that patent, thereby making itself a tort feasor. Whatever advantage there was in that invention, the defendant got by selling its transformers embodying that invention. And now, when it is confronted with the question of giving up the profits it made by that, it wants to show your Honor that it has embodied that thing imperfectly, or that the thing is absolutely useless.

I respectfully submit, that going back to the question, your Honor will see there is no foundation in the specification of the patent for such a question, or no foundation in the record for such a question.

Mr. FOWLER: The only transformers used by the defendant which the complainant in this case showed infringed, or made any proof of in this case, was the type of transformer which was involved in the Union Carbide case, which had horizontal spaces or openings in the core. That is the only apparatus made by the defendant which was before this Court.

The MASTER: We are drifting very far from the issues involved here, when we stop to discuss the question of infringement. The infringement has not only been found to exist by the decree of the Court which sends the matter to me for hearing, but it has been admitted on the pleadings. The utility of the invention cannot be inquired into before me, as an entirety. As I have stated before, the differences between counsel are, that the complainant claims the infringement (which is admitted) of Claim Four as a machine in its entirety. The defendant insists that the infringement of Claim Four should be segregated from the machine as an entirety.

That question I am not passing upon now, and shall not pass upon now. If the defendant is able to show that for any reason whatever the damages should be mitigated, I think he is entitled to do so. Whether the testimony which he is now producing will have that effect I am not able now to say. But it is only admissible at all upon the theory that he will be able to establish before the Court the fact that an infringement of Claim Four can be and should be

segregated from the infringement of the entire machine. If the counsel is of the opinion that the testimony which he is undertaking to produce here will go to show that the measure of damages is in any degree lessened, I think it is my duty to hear it, whatever view I may hold at the time the objections are made. I am not able at present to determine whether the testimony is relevant and
585 material or not, but the witness may answer the question subject to the objections which have been made, and in view of the position as stated by the Master, on the issues which are before him.

Q. 205 is here read as follows: To what extent do horizontal open spaces in the core of oil cooled transformers contribute, in your opinion, to the efficiency or success of such transformers?

A. In my opinion the open spaces in the core, as shown in the transformers in the defendant's exhibits, do not contribute to the efficiency, from an electrical standpoint, or to the success of the transformer as a whole. I base this opinion not only upon the results of the tests which I have made upon the two transformers, already described, but also upon my judgment of the benefits to be derived from such openings in the core.

I can state a few reasons why my judgment is in that direction. The reason why these open spaces in the core do not contribute to the successful operation of the transformer is that they serve merely as pockets in which a small amount of oil will stagnate. They do not contribute at all to the [convect-on] currents in the oil, and, therefore, have no effect whatever in contributing to the cooling. Moreover, the reduction in the volume of the iron caused by the presence of these openings will increase the load losses in the iron, due to the higher induction resulting from the diminished amount of iron present.

By the MASTER:

Q. 206. You mean diminished surface?

A. No sir, I mean diminished cross-section of the iron, which carries the magnetic lines of force.

Mr. BAKEWELL: In order to emphasize the position of complainant's counsel in this case, complainant's counsel calls the attention of the Master to the fact that if the Master will notice the language of the Answer he will see that it is broad enough in its scope to amount to a denial upon the part of this witness of the facts going to show utility, as found by the Circuit Court and the Circuit Court of Appeals in the Carbide case, which findings defendant admits, by paragraph 8 of its Answer, is binding upon this defendant. Not only so, but upon well settled principles of law this defendant is estopped from taking such position, and from denying the utility of the invention, the subject matter of Claim Four of this patent.

Furthermore, if the Answer of the witness is taken as confined to the question as put to him, and to a structure which showed
586 open spaces in the core arranged horizontally, his answer is subject to a similar objection, because it is true that in the

Carbide case the Court did hold that a transformer used by the defendant in that case, and which did have the open spaces in its core arranged horizontally, was substantially identical with the invention, the subject matter of Claim Four of the patent in suit.

I make this statement on the record merely to emphasize the position of complainant's counsel, and to call the Master's attention to what I conceive to be an erroneous and fallacious position taken by defendant's counsel, one which is not tenable and one which makes the testimony given by this witness not only irrelevant and immaterial, but incompetent.

Counsel for complainant declines to cross-examine the witness, relying upon the objections which he has already made, and which have been spread upon the record, and the objections made to the testimony of the witness Wells, which by the consent of the Master, are allowed to apply to the testimony of this witness.

At this point the further hearing of testimony was adjourned to Friday, November 10, 1905, at two o'clock P. M.

FRIDAY, *November* 10, 1905.

Met pursuant to adjournment as above on Friday, November 10, 1905, at 2 o'clock p. m. at the offices of Messrs. Fowler & Bryson in the Commonwealth Trust Building St. Louis, Missouri.

Present: Mr. H. H. Denison, Master; Mr. Paul Bakewell appearing in behalf of the Complainant, and Mr. Albert C. Fowler appearing in behalf of the Defendant. Whereupon the following proceedings were had:

WALDO A. LAYMAN, recalled in behalf of the defendant, testified as follows:

Direct examination.

By Mr. A. C. FOWLER:

Q. 207. Are you the same Waldo A. Layman who has previously testified in this case, being called as a witness for the Complainant, in the proceedings before the Master?

A. I am.

Q. 208. Please state briefly what your education has been to enable you to deal with electrical questions.

A. I am a graduate in mechanical and electrical engineering of the Rose Polytechnic Institute, and since graduation in 1892 have been in continuous practice of electrical engineering. In my
587 practice in electrical engineering, I have been engaged in both designing and testing electrical apparatus as well as its manufacture and sale.

Q. 209. How long have you been connected with the Wagner Electric Manufacturing Company, the defendant herein, and in what capacity have you been connected with that company? And please state the year in which you were employed in any capacities which you may mention.

A. I have been connected with the Wagner Electric Manufacturing Company since September, 1892. I entered the service of the company as draughtsman, and for a short time my duties were wholly confined to the draughting department. After six or nine months' service in the draughting room my time was divided partly between the draughting room and the factory. My first duty in the factory being in the testing department, where I assisted in the testing of motors, and other devices being manufactured. From assistant in the testing department I was advanced to the head of this part of the shop and for several years had full charge of all regular testing of apparatus manufactured, as well as all experimental work in the development of new apparatus. About 1894 or 1895 I was made assistant superintendent of the factory, and for three and a half or four years served in that capacity, my duties being of considerable variety; as, for example, testing new machinery, assisting in the draughting department in the designing of new apparatus, installing important apparatus outside the plant and in a general way assisting the superintendent in the direction of the various departments of the factory.

In 1898 I was transferred to the commercial department and in the capacity of assistant manager my duties became largely the answering of all general engineering correspondence and directing some of the general office work.

In 1901 I became the manager of the company, in which capacity I have since directed all parts of the business, both commercial and manufacturing.

Q. 210. Did you hear or have you read the testimony given in this case before the Master by Messrs. Johanneson and Foster?

A. I heard part of the testimony and have read this testimony since.

Q. 211. In answer to question 10, Mr. Johanneson testified as follows: "Yes, during the period that I was engineer of the Company it was my duty to also get up the prices or the cost of
588 the transformers. These costs were very carefully made up in every detail. Every item connected with the manufacture and with the material contained in the transformer was included in these costs."

What have you to say to this testimony?

Mr. BAKEWELL: I object to that question. I respectfully submit that this witness cannot be used now for the purpose of either contradicting the testimony of this witness in regard to these facts or going into any question in regard to the cost of manufacturing of these transformers. It is inaccurate for Mr. Fowler, in referring to this witness, to refer to him as having been called as a witness for the complainant. Technically that is not exact. Under this decree of the Court the Complainant had a right to search the conscience of the Defendant in this case to get an accounting. The Master, under the decree of the Court, had authority to call the defendant's officers before the Master and compel them to give a full and free answer to inquiry in regard to the extent of defendant's manufacture of these infringing articles and give all the information

which these officers could give in regard to the cost of manufacture of these articles, and anything pertaining to the inquiry on this account.

In view of these circumstances and in pursuance of this decree and under the order of the Master, Mr. Layman, an officer of the defendant corporation, was brought before your Honor and Your Honor heard his testimony. We asked him to give us full data in regard to the manufacture of these transformers and your Honor heard him say, and the record before your Honor will confirm the accuracy of my present statement, that Mr. Layman said that the defendant corporation did not have any data from its books or otherwise by which it could ascertain the cost of these infringing transformers.

That was the statement made by this witness (who is really, of course, hostile to us) when produced before your Honor in pursuance of this decree of the Court. It was the privilege of defendant's counsel to cross-examine this witness, but he declined to do so.

It was only in view of such statements made by this witness in the presence of your Honor that we were then forced to go to other sources of information in order to get the data by which we could ascertain the profits, on a reasonable basis made by this defendant in respect to these infringing transformers.

Now, I respectfully submit the first question to this witness by defendant's counsel goes right into the very heart of the question which I asked this witness when he was on the stand before,
589 and in respect to a matter which defendant's counsel had an opportunity to cross examine the witness about, but declined to cross examine him.

This question, it is true, is put under the guise of a question for the purpose of contradicting Mr. Johanneson. But Mr. Johanneson's testimony in regard to a matter about which this witness stated he could not answer. Now, I do not think this is a proper question to put to this witness. I do not see how it is. Your Honor not only heard the witness, but the attitude of the witness in regard to the whole matter.

That testimony was given after there had been adjournments and the witness had opportunity to make thorough investigation.

Mr. FOWLER: I submit the witness was called on behalf of the Complainant, and not only called on behalf of the Complainant, but subpœnaed on behalf of the Complainant. Now I do not know how any one could beforehand know what the witness was going to testify. Moreover, we think we have a perfect right to explain our position in *the* this matter on the previous testimony and contradict or correct Mr. Johanneson's testimony where it is inaccurate.

As to the fact that I did not cross examine this witness: I was not bound to cross examine, but reserved the right to call the witness when we were making out our case. I did not conceive it to be my duty to cross examine him to make out our case. I am simply endeavoring to try to make out our case.

The MASTER: The designation of the witness as a witness for the complainant of course does not injure any one at all. The

witness being an officer of the defendant made it possible for the complainant to call him, and it was his duty to testify when called. The fact that he was not cross examined at the end of the direct testimony does not prevent counsel for the defense from calling him now, certainly not for this purpose, and possibly not for any. I think it is perfectly competent for the witness to be called to testify with regard to what other witnesses who were also called for the complainant have stated. I do not know whether he is to corroborate or contradict the testimony of witnesses who testified here before, but the fact that this witness was called as a witness for the complainant does not debar him at all from questioning the acts or testimony of other witnesses for the complainant.

The objection is overruled.

A. Mr. Johanneson is mistaken in the general basis of his testimony. The figures which he has employed as costs were estimates in every sense of the word, and I have absolute knowledge of
590 the fact that they were not the absolute cost of the apparatus. Mr. Johanneson's duties as designing engineer also involved making up estimates of the cost based on his best judgment. But it was not the practice of the company to accept Mr. Johanneson's estimates as costs nor were they in fact ever relied upon as absolute costs.

I would define the word "cost" as employed throughout his testimony as "approximate estimates of cost."

Q. 212. In answer to Question 22 Mr. Johanneson states: "In fact, the cost of the transformer is made up of two elements the first being the flat labor and material values and including the actual cost of labor and material involved in the transformer. Second, the expense value, which included the salaries of officers, engineers, and all other employés not included in the flat value, and all other expenses connected with the manufacture of the transformers."

What have you to say to this answer of Mr. Johanneson's?

A. In arriving at estimates of cost it has always been our practice to estimate as nearly as possible in advance of manufacture the labor and material values, and to superpose upon those values an amount to cover general operating expenses.

Mr. Johanneson's estimates of cost as submitted in this hearing were not actual labor and material costs, in that they were estimates of labor and material made up entirely in advance of manufacture, and as to the expense superposed upon them, this, as he has elsewhere testified, was a percentage of the——

Mr. BAKEWELL: I do not see how we can go into this.

A. (continued). Estimated labor and material value. Mr. Johanneson uses the expression that this expense value included "all other expenses connected with the manufacture of the transformers." The expense percentages to which he has elsewhere testified do not, however, cover a very material element of the cost of manufacture, and that was the expense incident to mistakes of manufacture or defective workmanship. The estimates of labor and material costs

throughout a very large part of the period covered by this inquiry were seriously, and practically entirely, vitiated by expenses in manufacture which do not appear anywhere in Mr. Johanneson's estimates. His values as given for labor and material were based upon what he thought the apparatus should be manufactured for and did not in any sense involve any rebuilding of apparatus.

591 As an actual matter of fact, the factory was continuously engaged in the rebuilding of much of this apparatus. And the fact that the profits shown on the balance sheet of the company do not in any sense agree with our own expectations as to what we should have made in the business, is due very largely to the excess of cost of transformers over and above the preliminary estimates.

We employed in our business a system of job numbers with which we attempted to secure actual labor and material cost with which to check the preliminary estimates made by Mr. Johanneson or other members of the engineering department. In actual practice these job numbers showed costs practically invariably in excess of all estimates, and were of so little value in the predetermination of costs as to have finally led to the entire abandonment of the system, and the burning up of all the shop numbers on which reports were made up.

I recall distinctly that in the case of the Union Carbide transformers, estimates of cost were submitted by Mr. Johanneson in advance of the securing of this contract, and the business was booked on a basis which would have shown profit, had Mr. Johanneson's estimates of labor and material, and the percentage added to that, actually represented the cost of the apparatus. We kept a job number on this particular contract, it being as a rule our practice to employ a single job number for all large contracts, while on the standard running work we lump a large volume of business and carried through the cost of such apparatus in the aggregate. In this matter of the Carbide job number, the labor and material value, without any expense added thereto, were practically identical with the selling price to the customer, and I need not say that this particular transaction involved the Wagner Company in a considerable loss.

In the manufacture of apparatus of this character frequent disturbances arise to make the cost of the actual labor and material involved altogether different from the estimates, and Mr. Johanneson was frequently very wide of the mark from his predetermined estimates of cost of labor and material on this work.

During a considerable portion of the time covered by this inquiry, it was the practice of the company to endeavor to build all transformers to meet certain specifications as to iron losses. If when the apparatus came through and was submitted to tests, these tests proved in excess of the specification, the transformers were sent back to the erecting department, dismantled, and rebuilt. Mr. Johanneson's estimates of labor and material at no time incorporated any such rebuilding expense.

592 Further than this, during a considerable portion of this interval, very serious manufacturing mistakes were made. One exceedingly serious mistake was made which cost the company

in the rebuilding of apparatus about $90,000 in one year alone. This figure of $90,000 is estimated as nearly as we were able to get at it.

Mr. Johanneson was engineer in charge of the designing of transformers at that time under the direction of a superintendent, and this manufacturing mistake, which ran through the business of the company in its effects for three or four years, cost us an exceedingly large amount of money. There was nothing in the method of estimating costs nor in the expense percentage employed to in any sense cover such a condition of affairs.

When I testified to the fact that we had no figures on which we could base the actual cost of the apparatus through that interval, I had in mind all the discrepancies which vitiated and made useless to us the costs which have been introduced by Mr. Johanneson as being the actual cost of the apparatus.

I reiterate my testimony heretofore given that the company has in its possession at this time absolutely no reliable data on which we can arrive at the actual cost of all this apparatus. I am free to say that is my candid opinion that the apparatus built during this interval showed a cost to the company in excess of the billing price to the customer, due to the fact that there was involved a continuous and abnormal running expense due to the reconstruction of a very large percentage of the apparatus built. This entire matter involved the company in considerable financial difficulties.

In this same connection, I want to refer further to Mr. Johanneson's testimony as to the use made by the company of the estimates of cost compiled by him.

Mr. BAKEWELL: May it please your Honor, this witness is going into a long argument on that record.

The MASTER: I think that should be left until you are interrogated on that branch of the question.

Mr. BAKEWELL: Since this is to be a part of the special pleading on the part of this gentleman, who is practically the defendant in this case, if there is one thing which is established, and there are some things established, it is that on the question of profits the defendant is not permitted to charge up against the reasonable manufacturers' profit the expense he may have been to in the rebuilding of transformers or of the infringing articles. If there is any one thing well settled, it seems to me it is that.

593 The MASTER: For such a question as that, I hardly think it is worth while to take up time to argue before the Master. I think the Master would apprehend that situation.

Mr. FOWLER: Does your Honor rule it is not competent to show any loss in manufacture?

The MASTER: I did not make that ruling. I only stated there is a rule of law and practice, which Mr. Bakewell stated, which is perfectly familiar to the Master. But I have not ruled, and do not think I ought to rule at this time, whether or not that is a proper method to arrive at the damages.

Mr. FOWLER: As I understand the matter, your Honor, the complainant in this case has waived the question of damages and it is

merely the question of profits. Now, they claim that on this apparatus, the transformers that we have made during this period, we have realized a profit of some seventy-five thousand odd dollars. Now, we think we have a right to show that we did not realize any such profit; that if by reason of defective workmanship or anything there was no such profit made, we have a right to show that.

The MASTER: Upon that question, I am not at all clear that that is the proper method to arrive at the profits. But you may introduce that testimony subject to the complainant's objection, and of course it will be weighed according to my best judgment when we come to the conclusion of the matter.

Mr. BAKEWELL: In view of that, complainant's counsel states that he again wants to put upon the record that he objects most strenuously to any testimony that undertakes to show there has been a loss in the profits in this business by rebuilding the transformers or repairing transformers, or incident to the building of the transformers which were not sold, on the ground that that can not be used in mitigation of the amount of profits.

Q. 213. Mr. Johanneson further testified in this case in answer to Question 24 as follows:

"Question 24. In other words, as I understand you, in estimating the cost to the Wagner Company of making transformers during the period which I have repeatedly referred to, and mentioned in my last question, the transformer was charged with the flat cost of labor and material entering into it, plus 25% or 40%, the 40% rule applying, as I understand your testimony, chiefly during the last two years preceding November 1901: Am I correct in this? (Answer.) Yes."

What have you to say to that?

594 A. I think Mr. Johanneson aims at the correct facts in answering this question. In making up his estimates of cost he was under instructions during a considerable period of this time to add to his flat labor and material estimates a percentage and to regard the whole as flat cost. I can not absolutely contradict him as to the 25% or 40%. In the history of the company the percentage added has varied a good deal, an attempt being made to arrive at a percentage which would properly represent the actual general expenses of the company, based on the gross labor and material of the year's operation. I think during the last year or two, he is right in saying that his instructions were to employ 40%. As to the 25%, I do not recollect a time when we added such a per cent, my recollection being that we never went as low as 25% and never any lower than 33⅓, not always employing a flat percentage on the combination of labor and material, sometimes putting a much larger percentage on the labor and a relatively small percentage on material, as for example 90% on labor and 10% for material.

But Mr. Johanneson's intention, I think, is honest and correct when he speaks of having been instructed to add a flat percentage to his estimates.

Mr. BAKEWELL: I do not care for the witness to testify to Mr.

Johanneson's intentions. He was not asked for that and he is not competent to testify as to his intentions. He was asked to testify to facts.

Q. 214. In answer to question 35, Mr. Johanneson testified as follows: "During the time I was with the Company, a rule prevailed, which was to add a percentage of 25 to the factory cost, and this rule was always used as a base for ascertaining the selling price."

What have you to say to that?

A. No such practice prevailed in the business, and Mr. Johanneson is testifying about matters over which he had no jurisdiction and could only have hearsay information. As a matter of fact, the practice of the Company was to fix the selling price largely by what competitors were selling the same apparatus for. I think it is a general principle in manufacturing business that a company such as ours should not receive less than 25% profits on all its sales, to be in sound manufacturing and financial condition. But that we based our selling price on any such rule as this is absolutely incorrect.

595 I will illustrate the inaccuracy of it by referring to the schedule submitted in this hearing and also to the blue-print which was introduced by Mr. Johanneson. This blue print is marked "Complainant's Exhibit, Blue Print A" and is a series of cost prices which Mr. Johanneson says he compiled and on which all the prices of the company were based at that time.

In the last column of this blue print under the heading of "transformers" appears the gross estimated cost figures on all type G transformers.

In the first column of this table appears the size of the transformer by number. In designating the size of transformers in this table Mr. Johanneson has employed a system which has since been superseded, to a considerable extent. For example, what he calls "No. 2 transformer" is a "10-light transformer", and is commonly called to-day a 5/10 K. W. transformer.

If the number of the transformer shown here on this blue print is multiplied by five, it will always give the lights capacity; and if the number of lights capacity is divided by 20, it will give the kilowatt capacity.

In some cases — the schedule submitted in this inquiry a transformer is designated in lights capacity and in some other cases in kilowatts capacity. If the lights capacity is divided by 5, it will give the corresponding number employed in this blue print. One kilowatt in lights is 20 lights.

For example, in the schedule where 30 kilowatts appears the lights capacity is 600.

Now, Mr. Johanneson shows the cost of a ten-light type G transformer as $18.75. This is without the 25% profit which he says it was the invariable rule of the company to add. By referring to the schedule herewith (by which I mean the list of transformers in this inquiry stated to be infringing transformers, which was furnished by the defendant at the request of the complainant) and by referring to the general order No. 6203, on page 154*a*, which

was a sale made to William Farr, Asheville, N. C., on June 16, 1900 (the same month as this blue print is dated) a ten-light transformer is shown with price to the consumer at $18.34; while Mr. Johanneson's tabulated cost of this apparatus is $18.75 without any 25% added. We paid on this general order No. 6203 a commission of 10.6% to the salesman, and this commission amounts to $1.96 on this particular transformer. The selling price to the customer is 41 cents less than Mr. Jahanneson's cost estimate with the 25% profit; and adding the ten per cent commission to the salesman, the company received $2.37 less on this transformer than Mr. Johanneson figures as to the cost.

Similarly on General Order No. 6227 on the same page of this schedule, the Company sold to the St. Louis Electric Supply
596 Company of St. Louis, Missouri, on June 20, 1900, two 20-light transformers, type G. We received from the customer $18.34 apiece. No commission was paid on this sale, and therefore the net price received by the company was $18.34 each. Referring to Mr. Johanneson's blue print, the 20-light type G transformer is what he calls a No. 4 transformer. The net cost to the company, without any 25% added, is $20.96, and so on each of those transformers, we lost $2.62 on the cost.

I think it will be found by going through this schedule that all ten and 20-light type G transformers listed are sold without profit and probably with a loss on the cost estimates of Mr. Johanneson.

Referring to some of the larger sizes of apparatus as further disclosing the fact that we did not employ any such rule as Mr. Johanneson stipulates, in making our selling price, I cite general order No. 6331 on page 155*a* of the schedule. This sale was a 300-light type G transformer bought by the Monongahela Light & Power Company of Pittsburg, Pa., on July 2, 1900. Its billing price to the customer was $132.60. We paid $13.43 commission, and the net price received by the company was $119.13. Mr. Johanneson shows the cost of this transformer—or rather his estimate of the cost, as $88.85; or a profit, if his statement of cost were the absolute cost, would have been $31.48, or 36.4%.

Mr. BAKEWELL:

Q. 215. How do you identify this transformer he estimates with your transformer?

A. It is shown as a No. 60 and multiplying the 60 by 5, as above explained, gives a 300-light transformer.

These illustrations selected at random disclose the fact that the Company employed no such 25% rule in making up selling prices. The actual fact of the matter was, as I have several times stated, we based our selling price largely on the prices of competitors. This was invariably the case, where we were selling standard lines of product, as nearly all these transformers are.

We employed such a schedule as Mr. Johanneson has introduced in the form of Complainant's Exhibit Blue Print A, for such suggestive information as it might be worth.

On special apparatus, where there was no means of knowing what the competitors' price was, we made it a rule to take such an estimate as this Exhibit A as an example; I mean an estimate by Mr. Johanneson of labor and material plus a percentage and we loaded it with as much more in prices as we thought we could secure. Frequently we found our prices in competition out of line and in conducting negotiations with a customer, we held ourselves
597 in readiness when we found out what our competitors' price was, to get what we could and discard our wishes in the matter.

My statement in this respect will explain why in the general schedule of profits introduced in my own testimony when on the stand, it is impossible during any year there recited to make any connection between a 25% rule and the actual amount of the profits shown on the business done. There was not a time throughout the interval covered by the schedule of transformers involved in this case when the Company on its general business made anything like a profit of 25%——

Mr. BAKEWELL: On its general business, I understand you to say?

A. (continued). On its general business. I have previously stated in my testimony that it is absolutely certain we never made any such profits on our transformer business, nor the transformer business in the aggregate or the transformers involved in the schedule in this case. We are not simultaneously experiencing in any other branch of our business a deviation of cost of manufacture from estimated cost of manufacture with any other line of apparatus such as we experienced in the manufacture of the transformers involved in this schedule.

I have referred to the rule in the first construction of transformers by which, providing the core losses did not come up to the engineering design, there was a remounting of the iron. This was quite a general practice and was an original manufacturing cost. It was a very substantial item, and always a very uncertain item. It impaired seriously any such estimates as contained in Exhibit Blue Print A.

I have been very closely identified with the selling department of the business for a good many years, and I know positively that at no time were we able to employ any arbitrary rule as to a percentage of profit in the business, although we did aim at making, if possible, a general 25% average on the business. But as a matter of fact, the tabulated profits, previously stated by me in this case are far below any 25% average.

I might add in this connection, referring to the statement of complainant's counsel in connection with the closing of complainant's proof in chief on the accounting——

Mr. BAKEWELL: How is this responsive to the question?

The MASTER: I do not see yet exactly how it is. But of course it is all subject to the objection.

598 A. (continued). Mr. Johanneson's 25% rule is employed as a means of determining profit on the transformers listed in the schedule in this case. Taking the figures utilized by complainant's counsel, it appears that the gross volume of business done by the Company during the period of this inquiry was $2,314,774.73. The transformer- involved in the schedule in this case were sold to the customers at the gross aggregate price of $955,271.76. Deducting the aggregate selling price of the schedule transformers it appears that the business done by the company in apparatus other than that covered by the schedule was $1,359,502.97. On the transformer business involved in the schedule, commissions paid to selling representatives averaged from the entire business 8.6% of the price to the customer. If a similar average percentage prevailed over the business done by the company other than the transformers involved in the schedule, the commissions paid agents on this other business would have been, or were, $116,917.17, or the company received net from its other business, $1,242,585.80. If this 25% rule had prevailed in the business, the profit to the company would have been one fifth of this last figure or $248,-517.16.

As an actual matter of fact, the profits shown by the Company's balance sheets on all the business done over this period was only $182,001.02, or $66,516 less than the profit that would have been made on a business on a 25% rule in business other than that involved in the schedule.

Somewhere in Mr. Johanneson's testimony the statement is made that some of this other business was done on a basis of 20% profit instead of 25%. If all of it had been done on a basis of 20%, pursuing the same line of calculation as just above followed, the profits to the company on this total volume of business through the transformers involved in this schedule would have been $207,083.70, or $25,082.68 more than the actual profit made by the company on absolutely all the business during this period. If the 25% rule or a 20% *per cent* rule were correct for our business, the conclusion would be inevitable that the transformers involved in the schedule cost the company a reduction of profit of $66,516 providing the 25% rule were employed, or $25,082.68 providing a 20% rule were employed. Or, as a matter of fact, we would have been better off if we had never done any of the business involved in the schedule of this inquiry. I am of the opinion that some such condition of affairs actually prevailed, to the extent of it being probable that our profits would have been larger without the transformer business in the schedule, than it is with it.

599 Mr. BAKEWELL: I object to all this testimony of the witness, in fact I object to the entire answer of the witness as pure argument and not responsive to the question.

The MASTER: It is all taken subject to objection.

The MASTER:

Q. 216. You have shown that your balance sheet showed some degree of profit during the years covered by this schedule: Is that

profit which you have spoken of a net profit over and above the increase of the plant and increase of productive power, increase of capacity, which might have been installed during those years?

A. Any profit shown in the Company's balance sheet at any time includes all increase in equipment amounts. In other words, in adding to the capacity of the plant, such increases are never regarded as an expense but in summing up the year's business, if anything has been added to the equipment during that year that addition will be a part of the profit shown. In other words, if we show a profit of $100,000 for the year, we may not have any of that in cash, but it will be all represented in increase of the plant or in expansion of the business.

I would say that as a matter of fact, during this interval when some of these profits were being shown, the size of the factory was being increased faster than the business provided revenue to pay for and the capital stock of the Company was expanded to provide the additional funds necessary for the extensions.

Mr. FOWLER: I understand your Honor's question was directed to the question as to whether any of these profits were distributed in the way of increasing the plant.

The MASTER: Yes, but what I meant was, did the profits enter into the increase of the plant during these years? That is, whether the plant was increased out of the profits and the profits shown on the balance sheet, were net cash profits excluding the increased value of the plant. That was what I was trying to get at.

A. I would say it was a very unusual thing for the profits shown on the balance sheet to be available in cash, except for a small percentage, in any business that is growing. If it were a mercantile business where the volume of stock was standing still, the profit for the year might all show in cash; but in a manufacturing business like ours, with all the requirements for investment in stock or tools and machinery nearly always eats up either all or part of the profits shown for that year.

Mr. FOWLER:

600 Q. 216. But still the profits shown on any line of manufacturing appear on the balance sheet or books of the company as profits due to that line of manufacture? Is that correct?

A. They are real profits in the sense that the Company has the value somewhere, either in its treasury in the form of cash or in equipment for which there is an actual money value in the business.

The MASTER:

Q. 217. But in either form it is profit?

A. It is profit, absolute profit. So the figures I have given in the schedule of profits for five or six years would represent to any of our directors cash values.

Mr. FOWLER:

Q. 218. In your last answer you referred to the balance sheet and certain figures: Were those figures taken from the schedules as shown in this testimony, and on the estimates as given in the testimony, or did you attempt to give any independent figures from the books of the Company?

A. All the figures I have employed are taken from the statement of complainant's counsel, and complainant's counsel states they are all made up from the schedule I have submitted in my previous examination or from the schedule and from the statement of gross business and profits which somewhere else appears in the testimony. But the figures are all figures that have been employed in the direct testimony and I have employed them in my last answer as enabling me to show that Mr. Johanneson's statement as to the rule employed by the company in making up prices was entirely erroneous.

Q. 219. In one of your previous answers you referred to mistakes in manufacturing, the cost of mistakes in manufacturing, and to the loss of some $90,000 during, I believe, one year. I wish to ask you whether that loss to which you refer is included in this period covered by this typewritten schedule of transformers?

Mr. BAKEWELL: That is objected to. It does not, in the first place, show what the loss refers to, and so far as the change or repairing of this apparatus is concerned, if it relates to these transformers and these infringing transformers, that, on well settled principles, cannot be charged against the profits.

Mr. FOWLER: I modify my question and limit it to the transformers of the type involved in this controversy.

Mr. BAKEWELL: That question is objected to.

The MASTER: The witness may answer subject to the ob-
601 jection.

A. The loss I refer to as being a loss for which Mr. Johanneson's estimates in no way provided, was a loss on the type of transformers and on a great many of the actual transformers listed in the schedule herewith, and was confined to the interval covered by this inquiry.

The expense of manufacturing, as I have stated, which vitiated Mr. Johanneson's labor and material estimates, were of two kinds, or I may say of three kinds:

First, errors of judgment on Mr. Johanneson's part in making up these labor and material estimates. In other words, making them entirely too low. It was a natural weakness of his and always a natural weakness for a man occupying the relation Mr. Johanneson did to the business, to have the labor and material estimates come as low as possible, it being an easily understood ambition on the part of such a man to have the apparatus on which he was engaged to show as much profit as possible, and we had a great deal of trouble with all of Mr. Johanneson's labor and material estimates in that they actually ran much below the job numbers

which we carried. Mr. Johanneson always charged the job numbers with being incorrect and unreliable. And I am aware of the fact that a great many job numbers were incorrect, simply because the mechanics in the factory would charge the labor to their own number. And in taking material out of the stock room they would also put the wrong numbers on their material requisitions. But the net result was that we were constantly at sea between doubting the accuracy of such estimates furnished by Mr. Johanneson and not being able to establish by our job numbers just what the actual labor and material was. As I have said, the system was of so little value as to put the whole matter of costs entirely up in the air. And the best we could do was to see from our balance sheet at the end of the year whether we were making any money in the business or not.

The second error in Mr. Johanneson's estimates was the fact that in the construction of apparatus there was a considerable process of adjustment to make the apparatus meet the engineering specifications. I am of the opinion that this sometimes made the labor estimates run 50 to 75% in excess of his tabulation. Our superintendent at that time was very exacting in his requirements as to the transformer product, and if the transformers did not thoroughly meet the engineering specifications, his uniform rule required the readjustment of the apparatus to have it meet the specifications, and this might properly all be termed an original cost of construction.

602 A further source of additional cost, not taken into account and coming under this same classification, was the cost of rebuilding due to insulation breaking down, when the transformer in its partially constructed state was subjected to inspection tests. The breaking down of the insulation very frequently required the entire rewinding of the apparatus and was a very expensive operation and almost doubled the labor cost involved in the apparatus.

There were always a great many hitches of this kind in manufacturing and we invariably found that the tendency of the engineers in making up estimates throughout the business was to ignore them and make up their estimates on what they thought the labor and the material would be.

The third source of error in these estimates was not taking into account the necessary rebuilding of the apparatus due to inherent defects resulting in the return of the apparatus to the factory by the customer.

Mr. BAKEWELL: The witness is directly going into the thing that the Court has said over and again can not be considered. I object to the answer of the witness as utterly incompetent, irrelevant, and immaterial to any issue in this cause, it being purely a matter of partisan argument.

Mr. FOWLER:

Q. 220. You referred in your last answer, under the second heading, to the fact of the superintendent being particular about

transformers coming up to the engineering specifications, and about the insulation of transformers breaking down when they were tested: Will you state whether this occurred in the factory before the apparatus was sent out and delivered complete as an article of manufacture or whether such apparatus was sent out and afterwards returned to the factory.

Mr. BAKEWELL: I object to that as incompetent, irrelevant, and not in any way tending to contradict the witness Johanneson, nor in any way undertaking to show no profits in any particular instance, or tending to show what the profits actually were in any particular instance.

The MASTER: The witness may answer subject to the objection.

A. It was always done in the process of original manufacture. In transformer manufacture, the apparatus is frequently subjected to progress tests so that we may be aware of its physical condition as well as its electrical conformity to the requirements before the manufacture reaches a complete stage. This breaking down of the transformers was sometimes early in the stage of manufac-
603 ture, sometimes late in the stage of manufacture, but always before the finished production went to the warehouse for boxing. The dismantling of the apparatus to bring the core losses within the requirements was always in the process of manufacture and the information on which to do this remantling was secured by tests made when the apparatus was probably 60% or 65% completed. Sometimes transformers came up to 65% condition two or three times before the tests showed them to be in condition for carrying through to entire completion.

At this point an adjournment was taken to Saturday, November 11, 1905, at 10:30 o'clock a. m.

NOVEMBER 11, 1905.

Met pursuant to adjournment as above on Saturday, November 11, 1905, at 10:30 a. m. at the office of Messrs. Fowler and Bryson, in the Commonwealth Trust Building, in the City of St. Louis, Missouri.

Present, Mr. H. H. Denison, Special Master, Mr. Paul Bakewell, counsel for the complainant, and Mr. A. C. Fowler, counsel for the defendant; when the following proceedings were had:

Continuation of the direct Examination of Mr. W. A. LAYMAN, by Mr. A. C. FOWLER.

Q. 221. Yesterday you gave some specific illustrations from the typewritten schedules of transformers, submitted in this case before the Master, showing the inaccuracy of Mr. Johanneson rule of 25% being added to the cost of the transformer to determine the selling price of such transformers; and you used in this connection the blue print "Complainant's Exhibit A" produced by Mr. Johanneson: Are you able to give any further specific illustrations in this connection, and if so, please do so. [A]

A. After adjournment last night I again looked over the blue

prints "Complainant's Exhibit A" and "Complainant's Exhibit B" for the purpose of determining the difference between them and also for the purpose of seeing whether about the same relation existed between the schedule of transformer prices on "Exhibit B" as between the schedule of transformer prices "Exhibit A".

Exhibit B is dated July 31, 1900, while Exhibit A is dated June 26, 1900. The chief difference between the two blue prints seems to be that in the case of Exhibit A Mr. Johanneson has added
604 40% to the sum of his estimates of labor and material, and the price under the column headed "packed transformers" includes this 40%. In Exhibit B it is specifically noted on the blue prints that "these costs are without per cent added". To determine what difference it would make between the blue prints by adding the same percentage to Exhibit B as added to Exhibit A, I mutiplied the values out, and I find the two tables are not substantially different as to his estimated cost of "packed transformers" when this 40% is included in Exhibit B.

For example, his No. 2 Type G Transformer in Exhibit A is estimated to cost when packed $18.75; and in Exhibit B this becomes $18.15. I introduce a memorandum showing these comparisons in a large number of sizes between No. 2 and No. 100.

The MASTER: That, of course is for the benefit of the Master, for shortening his labors.

A. I thought it would serve that purpose.

The MASTER: It ought to be made intelligible to me without having to study it out too much.

A. This memorandum is as follows:

Size of transf.	Price of packed transf. Ex. B.	Price of packed trans. Ex. B. Plus 1.40.	Price of packed transf. Ex. A.
2	$12.97	$18.15	$18.75
4	14.04	19.65	20.96
6	17.83	24.96	24.22
8	20.45	28.63	26.05
12	24.70	34.58	36.16
20	33.20	46.48	48.23
30	51.42	71.98	72.21
40	52.70	73.78	84.92
60	60.12	84.16	88.65
80	98.69	138.16	133.64
100	106.26	148.76	148.85

I took a few moments also after adjournment to compare the figures of Exhibit B blue print with the selling prices in the schedule of transformers for the purpose of seeing whether the figures in the schedule of transformers in any way corroborated Mr. Johanneson's 25% rule as to the selling price of apparatus. I have also selected instances during the months of August, 1900, the blue print being dated July 31, 1900.

General Order No. 6716 on page 159 *a* of the Schedule covers the

sale of an 100-light Type G transformer, on which the net
605 price received by the Company, in the last column, is $185.01. The cost of this transformer, according to blue print Exhibit A, is $138.16, or the profit is $46.95, which is 34% of the blue print price.

Similarly, General Order No. 6769, on the same page, covered a sale on August 13, 1900, of two 60-light transformers, at a price each net to the Company of $38.61. According to Blue Print Exhibit B, plus 40%, the estimated cost is $34.58 each, and the profit would be, according to such basis, $4.03, or [$] 11.7 per cent of the blue print price.

Similarly General Order No. 6789, on the same page of the transcript, covers a sale on August 14, of a 10-light Type G transformer at the net price to the company of $31.50 each. According to blue print Exhibit B the estimated cost would be *be* $18.15, with the 40% included or a profit of $3.35 each, which is the equivalent of 18½% on the estimated figures of the blue print.

Similarly, in General Order 6805 on page 160*a*, which covers a sale on August 16, 1900, of two 1 kilowatt or 20-light Type G transformers at a net price each to the company of $18.74. The estimated cost of these, according to blue print Exhibit A, with the 40% included, is $19.65, or a loss of 91 cents each, which is a loss of 4.6 per cent.

Similarly, under General Order No. 6914, on the following page, 161*a*, there is a sale under date of August 25th, of one 100-light Type G transformer, on which the net price received by the Company is $63; the estimated blue print cost with the 40% added would be [46.48 per cent,] or an estimated profit of $16.52, or a percentage of 35½.

I just selected these few instances at random to illustrate my statement that there is no connection between the selling prices received by the Company and any such estimates as these exhibited by Mr Johanneson in these exhibits.

The MASTER:

Q. 222. Does that result from the fact, as you stated yesterday, that you were obliged in the conduct of that business, to make your prices according to the prices of competitors, and sometimes your price was just what you were obliged to take, or just what you could get?

A. In this line of business there are a great many competitors in the field. I suppose there are ten or fifteen companies manufacturing this line of apparatus and it is necessary for a company like ours to base our prices on the pace set by our *creditors*.

Mr. BAKEWELL: The Master is evidently speaking of the time covered by this accounting.

606 A. That has been the case ever since the company has manufactured transformers, and was the case throughout the period of this schedule. It is the case to-day and it is quite a general practice in manufacturing.

The MASTER:

Q. 223. In other words in the conduct of all business like that, practically each sale stands on its own bottom?

A. Each sale stands on its own bottom, except in so far as with a standard apparatus of this kind you soon get on to your competitor's prices, and no matter what may be your own desire, you must meet his price, or drop the business.

In these illustrations I have taken not transformers entirely of the same size but have given figures on five different sizes showing a wide range of estimated profits, between a loss of 4.6 up to a profit of 35.5 per cent. The whole question of the relation between estimated cost and selling prices was very much "up in the air" to use a slang expression.

I have not attempted at any time in my testimony to say that it was not the practice of the company to make up estimates of this kind; but they were practically useless to us; and I have endeavored to find in the factory tracings of these blue prints, or copies of the blue prints, but have been unable to locate them since they were introduced into the testimony. I have asked our superintendent, and superintendent of the sales department, and the winding department foreman, and none of them have any such figures. I do not know where they are. But I remember having seen such data as this. The point I want to make in connection with that is, that they were purely estimates and could not be at any time relied on as actual representations of the cost.

I might say there is no question about these (referring to Complainant's Exhibit Blue Print A and Complainant's Exhibit Blue Print B) having been made in our engineering department, because they bear all the earmarks of the genuine Wagner tracing, the style of lettering, and the general form of the production seems to be in line with what I know we were accustomed to doing.

Mr. FOWLER:

Q. 224. Mr. Johanneson testified for the complainant before the Master as follows: "Question 37. Referring now, generally, to the transcript of record of transformers furnished to us by Mr. Layman, which contains, under different headings, the number of the order, the name of the customers, the residence of the customers, the date of the sale, the number of the order, the number of the transformers sold, the size, time, the price to the customers, the total price to the customers, commission to agent, net to company, do you find anything lacking in that data which might be desirable
607 or necessary, assuming all of the records of the Wagner Company to have been preserved, to enable you to identify any particular transformer mentioned in that list, from the records of the Wagner Company, and ascertain the cost of such transformer to the Wagner Company, and if so, what data is lacking?"

"Answer. Two very important identifications are missing."

Question 38. What are they?

"Answer. These are the voltage and the frequency of the transformer."

He also testified as follows:

"Question 41. If the voltage and frequency were given in this tabulated statement of transformers, made and sold by the defendant between June 24, 1896, and November 19, 1901, with the other data given in this tabulated statement, and assuming the records of the Wagner Company to have been preserved, what have you to say as to whether or not you would be able to determine, if you had access to the complete records of the Wagner Company, the cost to that company of the transformers given in this list?

"Answer. It would be quite possible to get at the correct factory cost, to within a very small per cent."

"Question 42. What do you mean by very small per cent."

"Answer. Well, to within approximately two per cent."

What have you to say to this?

A. My recollection is that I introduced in the schedules all the information and data asked for. The value of the frequency and voltage in connection with the schedule would simply be to identify the schedule with such an estimate as Mr. Johanneson has introduced in complainant's Blue Prints A and B. It is of course, true that a 25% cycle transformer is much more expensive to build than a 60 cycle transformer. And a ten thousand volts transformer is much more expensive to build than a one thousand volts transformer. But there is a complete identification of the sale, and the point at which Mr. Johanneson aims, I think is fully met by my statement that upon those specific transformers, no matter how much more identification, or what detail of identification were introduced, it would not be possible for me to give the cost of the apparatus. And I do not believe that the omission of the voltage and the frequency from the schedule has any vital bearing on the situation; and it certainly is not any evidence of my good faith in the matter, because I would have freely permitted the secretary of the Master to get this information while she was going through the general order books, if it had been asked for, as the information is on the face of the order
608 in every instance, and could have been copied without any additional labor, to speak of, in this schedule, if it had been requested.

Mr. Johanneson makes the statement that if that information had been included he would have been able—or, rather, some one would have been able, to estimate the cost within two per cent. of the actual cost.

My reply to that statement is, that what Mr. Johannessen means is, that he could have taken that particular transformer and have made up an estimate which would have come within two per cent. of some such estimate as he has made in these complainant's exhibits Blue Print A and B; which would in no sense be within two per cent. of the actual cost.

Q. 225. What knowledge had Mr. Johanneson and Mr. Foster, who testified for the complainant, of the practice of the selling department of the Wagner Company in establishing or fixing selling prices?

Mr. BAKEWELL: That is objected to as incompetent. He can not testify what knowledge he has.

The MASTER: I think the question is improper in that form, calling for what knowledge another party has.

Mr. FOWLER:

Q. 226. I will change that question. What means had Mr. Foster and Mr. Johannessen of knowing?

A. Neither of these gentlemen had any connection whatever with the commercial side of the business. When I say they had no connection, I mean throughout their entire connection with the Wagner Company, neither of them had any connection with the commercial department. Mr. Foster came into our service as a clerk, coming right from the Manual Training School, as I remember it, he having had no connection whatever with any other manufacturing company; and his clerical work throughout his service was entirely in the engineering department.

Similarly Mr. Johanneson came out of college, without having served any other manufacturing company, and his entire experience since leaving college, up to the time he resigned to go into the service of the Westinghouse Company, was secured in our service; and while in our service, he was entirely in the engineering department of the business. Mr. Johanneson succeeded to quite a good many of my own duties, when I was transferred from one branch of the business to another.

In the early days of the company I personally tested all transformers, and when Mr. Johanneson came into our service, he took these duties off my shoulders, and I, personally, taught him how
609 to test transformers. From the testing of transformers he was gradually shifted into the calculating of the windings, and as year after year passed in our service he was advanced to the position he finally occupied, of being engineer in charge of the computation of transformers. This service never involved his having the slightest connection with the selling department of the business. He was never sent out of the factory to solicit business, and very rarely to correct troubles.

The knowledge that Mr. Johanneson and Mr. Foster both had as to the sales practices of the company, were, therefore, all hearsay, except in so far as sometimes correspondence which contained selling prices of the apparatus to the customer got into their hands in connection with filling the orders. Sometimes we send the entire file of correspondence bearing on an order into the engineering department, so there can be no question of the factory fully understanding the conditions imposed upon us in filling the order. I have no doubt that frequently in this manner Mr. Johanneson, and perhaps Mr. Foster also, although I think it less likely in the case of Mr. Foster, had means of knowing just what the actual net price the company was receiving for apparatus. In this fashion I believe Mr. Johanneson must have known what net prices the company was receiving for Type G transformers, such as covered by the estimate sheets Complainant's Exhibits Blue Prints A and B.

I fail to comprehend how he could assert that a 25% profit prevailed in the business. If he had retained in his possession any of these selling prices on apparatus, as he seems to have retained the

blue prints on his estimates of costs, Mr. Johanneson and Mr. Foster had neither had any experience in the way of directing in an executive capacity a manufacturing business, and I doubt very much whether either of them has a correct idea as to the underlying principles in conducting a manufacturing business. Their connection with the company was always circumscribed. We were manufacturing quite a number of other lines of machinery, as for example, single phase alternating current motors, direct current motors, switch boards, switch board instruments, motor generator-sets, and other devices. Mr. Johanneson had no connection whatever with any of these other lines.

Mr. Foster, in his capacity as a sort of secretary to the superintendent, was thrown in contact with these other lines and moreover in about the same manner he was in contact with the transformer work. But neither of them was in any sense a participant in establishing the selling prices or the selling policy of the company.

610 It is always the case that men in the engineering department of the business, and in fact, throughout the departments, have a very strong curiosity as to what is going on in the commercial side of the business; but it has always been the policy of the Wagner Company to draw a clearly defined line between the commercial side of the business and the engineering department, and we have never hesitated to make the engineers understand that it was none of their business as to what was going on in the main office. Therefore, any such information as Mr. Foster introduced in his testimony, in the way of one of our circular letters, did not come into his possession by any legitimate process, and such information was supposed at all times not to be in his possession.

I repeat that I believe any knowledge either of them may have had as to selling prices was hearsay, largely.

Q. 226. You testified before the Master in this case as follows:

"Question 116. Do you not know as a matter of fact, that your company has on hand, and has had on hand, from year to year, figures which show cost of manufacturing of these various sizes and types of transformers."

"Answer. Such figures have been made from year to year, but whether they are on hand I can only tell by further investigation."

"Question 117. And these figures are accepted as correct for the purpose of your company's business, aren't they?"

"Answer. They are not accepted as cost price, but are used for fixing selling price, together with the competitors' prices of other manufacturers."

Please state if you now have any change or modification or correction to make in these answers.

Mr. BAKEWELL: If your Honor please, that is clearly incompetent. Here this witness, one of the officers of the defendant corporation, a man who expressly stated on the stand was the only man who could give us this information, if any one could, was by this question asked on direct examination before your Honor last spring, or whenever it was, when he was on the stand before. The time for defendant's counsel to ask him in regard to these questions was on

cross-examination. There was plenty of time, plenty of adjournments, but instead of that, with the record before the counsel, he waived his right to cross-examine. Now I respectfully submit he can not go back to this testimony of that witness now, for the purpose of asking him this question. He has had his chance, he was had his day in court, as far as that is concerned, and he has
611 waived his right. If he had asked him that question on cross-examination, I might have had questions to ask him growing out of that, and it might have affected very much the testimony which the complainant would have taken thereafter before closing its case in chief. I think this question is utterly incompetent, and can not be asked the witness at this stage.

Mr. FOWLER: If your Honor please, at the time this evidence was taken, Mr. Johanneson had not been produced as a witness, and counsel for complainant seems to assume all the time that he knows what the witness is going to say in response to this question. His attitude now is that the witness is going to change his answer. I think it is competent to ask the witness to explain any inconsistencies, if there be any, between his statement, and what Mr. Johanneson has stated, and the records he has produced, and that it is entirely competent. I could not have asked him before.

Mr. BAKEWELL: The gentleman speaks of my knowing what the witness is going to say. I haven't the remotest idea what the witness is going to say, and I care very little what the witness is going to say. But I do contend that there are certain rules of evidence which must apply in this case. On counsel's own statement, he says, Mr. Johanneson had not been examined; that is true. But the position I take is as to the attitude of this witness when called to testify before your Honor. He did make that statement, and his counsel had opportunity to cross-examine him and waived that right. I maintain it is incompetent for this witness to be asked now on this examination what would only have been competent on cross-examination of this particular witness when originally called.

The MASTER: So far as the objection is concerned, if a witness has made an error in his testimony, in an equitable proceeding, and it is discovered afterwards, I do not think it is ever too late in the course of the proceedings, for the court in its discretion to allow a correction. But in this particular question, the witness has stated, only a few moments ago, that upon further search he had not been able to find any records whatever corresponding to Complainant's Exhibit- Blue Prints A and B, which have been preserved by the Company, upon which such estimates were made. It seems to me that in that answer this question has already been answered. If I disapprehend the trend of the question, possibly that may not be the case. The witness may answer the question subject to the objection. I must say I do not see the pertinency of it myself at this stage.

612 A. I have no modification to make of my answer to either of the questions referred to. The facts are as I then stated them.

Mr. Johanneson's testimony has been employed to vitiate my rep-

resentations in this hearing, and I can only say, as to the difference between Mr. Johanneson and myself that he is testifying throughout without any knowledge whatever as to the profits made by the company. He is continually standing behind a screen——

The MASTER. That is a sort of argument, Mr. Layman, which I do not think it is proper for a witness to make.

A. Going back to the direct question: I made the statement, in answer to Question 116, that figures were made up from year to year bearing on the matter of cost, and when I made that statement, I had in mind such estimate sheets as have been introduced by Mr. Johanneson. But when it came to testifying that these were absolute costs, I was not able to do so, being well aware of the fact that they were not cost, but very wide of the mark.

In answer to Question 117 I made the direct statement that such estimates were not accepted as cost price, but were used for fixing the selling prices, together with the competitors' prices of other manufacturers. When we could use the factory estimates, of course, as a basis of selling prices, we endeavored to do so, as I have before stated. But as a matter of fact, in so far as the schedule of transformers involved in this hearing goes, we were up against a condition which prevented the use of any such estimates in fixing the selling prices. These being standard products, in probably 95% of the business done under the schedule, we were controlled by the selling prices of our competitors. And such estimate sheets were of no particular value, and have never been accepted by us as representing the actual cost of production, during any period.

Q. 227. In your testimony before the Master, you testified as follows:

Question 132. And you are not able to give the data from which we can ascertain the cost of manufacturing transformers?"

"Answer. I am not.

"Question 133. And the profits made on the transformers?

Answer. I am not able to give that information.

"Question 134. You wish to be understood as stating that you have carefully examined the books of the company and that the information called for at the last session can not be ascertained from the books of the defendant corporation.

"Answer. Yes, sir."

613 In view of the testimony of Mr. Johanneson, do you wish to make any correction or modification of those answers?

Mr. BAKEWELL: That is objected to. There was a most positive and direct question asked of that witness, through whom we were trying to search the conscience of the defendant, through its proper officer. After he had plenty of opportunity for investigation, there is his statement in regard to a material matter. I respectfully submit that defendant's counsel was present, as your Honor well knows, and the record shows that after that question only had been written out, there was a waiver of cross-examination, and we were put to the necessity of going to Pittsburg to take the testimony of these other gentlemen, so as to get as best we could, the facts in regard to this case. I respectfully submit this is an improper question to ask.

There was a time when the question could have been asked properly, but that time is passed. I think the defendant and defendant's counsel must abide by the result. I think the question is an incompetent question to ask of this witness, and it is an impertinent question to ask this witness at this stage of the case.

The MASTER: My ruling on this objection will be the same as before. I have very grave doubts as to the propriety of the question at this stage; but the witness may answer it subject to the objection, so the whole matter will appear upon the record.

A. I have no change to make in my answer to either question. I have freely and fully given all the information I can give as to the profits made on this apparatus, in submitting the schedule of profits in our business, appearing on page 164 of this record. I am unable to distinguish the profits made on the transformers, if any were made, or profits made on the balance of the business done by the company.

Q. 228. Mr. Johanneson in his testimony before the Master, on page 11, testified as follows:

"Question 29. What have you to say, in view of the practice which you have referred to prevailing at the Wagner Company's place of business during the time referred to in my last question, as to whether or not, while you were with the Wagner Company, and during the period referred to, it was possible to ascertain from the records of the Wagner Company the cost of transformers made by that company, which cost included, as you have stated, the flat cost of labor and material plus a certain percentage added thereto, to cover generally the expenses of the business, or that proportion of the expenses of the business, chargeable to the transformers?

614 [*Q.*] Answer. It should be possible to ascertain these costs? If the original tabulated sheets had been destroyed, they could arrive at the cost of practically every transformer which appears on the transcript referred to, by referring to the inventories of the years included in same."

Mr. Johanneson testified further on this point, on page 27, as follows:

"Question 64. So it was possible, by reference to the inventories, to get at the cost of the various transformers made?

"Answer. Yes.

"Question 65. On these occasions when you had reason to refer to the inventories for the purpose that you have stated, did you find that the inventories gave you the data you were looking for?"

"Answer. Yes, sir. It was usually that I looked for some piece of apparatus or transformer that was on hand at the last inventory, and I wanted to price it the same as it was priced the previous time.

"Question 66. You would find the price or cost of that particular part of the apparatus in an inventory, would you?

"Answer. Yes."

What have you to say to these statements in this testimony?

A. In his answer to Q. 29 Mr. Johanneson again assumes that such estimates of cost as he has submitted in Complainant's Exhibits Blue Prints A and B are the actual costs of the apparatus; and the

difference between him and me is entirely in the fact that I call them estimates, and he calls them costs. I say that they were not accurate estimates, and he says they are absolute costs.

Mr. BAKEWELL: I call the attention of the Master to the fact that Mr. Johanneson in his testimony does not confine it to these blue prints, but distinctly says that every transformer that appears in the schedule, by referring to the inventory——

The MASTER: I understand.

A. I refer to the matter of inventories; Mr. Johanneson is assuming that the figures carried into the inventories were absolute costs of the transformers; while, as a matter of fact, such figures were authorized figures at which to price the apparatus for inventory purposes, but were not cost prices.

During my connection with the commercial side of the business, the practice of the Company in pricing inventories has varied over a wide range. When I first came in contact with the matter of inventories, it was the practice of the company to price at the
615 net selling price, after the deduction of agents' commission.

The practice of the company has from year to year involved a continuous reduction of these figures. And we have never employed inventory prices which could be stated as being the costs of the apparatus manufactured during the preceding year. Inventory prices are more accurately described as being prices at which we would like to have cost prices, and prices which we endeavor to have the factory equal as cost prices. But the actual fact of the matter is, that the profits of the company could not be determined by employing such prices as cost prices for the sales made.

Q. 229. Will you please state how the inventories were made up and upon what they were based?

Mr. BAKEWELL: That is objected to as incompetent and as calling for secondary evidence, the inventories themselves being the best evidence of how they were made up.

Mr. FOWLER: The question does not call for him to state what was in these inventories, but what was the practice in making up inventories and on what they were based.

The MASTER: In the first place, I think it would be better to ascertain what was the practice of the company with regard to making inventories and whether those inventories are available.

Mr. FOWLER: I have not looked at the inventories myself.

Q. 230. Was it the practice of the Wagner Company to make up inventories, and if so, how often?

Mr. BAKEWELL: That is objected to. It is very clearly indefinite, and must be confined to the period covered by this controversy.

Q. 231. The question is limited to the period included in these schedules.

A. It was the practice of the company to make at least one inventory a year, and I think sometimes two a year were made

during the period of this schedule, and in making up such inventories, there appeared——

Mr. BAKEWELL: That is objected to. The question is about the practice. He can not testify about anything that appeared there; they speak for themselves.

The MASTER: The question is answered. It inquires simply whether such inventories were made and how often; it does not inquire what they contain.

Q. 232. Are those inventories available at the present time, covering the period of these schedules of transformers?

616 A. I think they are, or at least they ought to be in the vaults of the company.

Mr. FOWLER: I will say to the Master that on this matter of inventories I shall drop the matter for the present, because I have not examined them and do not know anything about them.

The MASTER: I see of course that will be necessary.

Q. 233. Please refer to the statement of Complainant's counsel in connection with the closing of complainant's proof in chief on the accounting, under the second heading on page 4, in which the second rule for ascertaining the profits of the defendant was based, and which complainant's counsels claims, as based upon Mr. Johanneson's testimony, that they are entitled to $75,093.62, on the theory that this constitutes 41.26% of the total amount of business done by the defendant, the Wagner Company; and this per cent. it is claimed, as I understand it, constitutes the infringing part of the business for the six years covered by these schedules. What have you to say to this?

Mr. BAKEWELL: Objected to as absolutely incompetent and improper. In the first place, the statement of defendant's counsel, as will appear from the printed statement of complainant's counsel, to which he refers, is hardly an accurate statement of the position taken by complainant's counsel. And in the second place, the question can not call for anything more than an opinion or argument from this witness.

Mr. FOWLER: I am quite willing to modify the question in any way to make it accurate. It seems to me it is an accurate statement of what is contained in this claim that we have made $75,000 profit. Counsel does not point out wherein it is inaccurate, and my purpose is to show from the testimony of this witness there has been no such profit made as claimed. This is the vital part of this whole matter. Complainant boils it down by a system of reasoning based on Mr. Johanneson's figures, that it is entitled to $75,000 profits which we have made. Now I have asked the witness concerning this very matter based on Mr. Johanneson's figures, and as contained in this statement. I think it is entirely proper; it is certainly relevant and material.

Mr. BAKEWELL: My statement was based upon my conclusions from Mr. Johanneson's testimony. It may or may not be proper for the defendant to undertake to show that Mr. Johanneson was

incorrect in his statement. But I respectfully submit this question is not a competent question and is calling for a mere argument from the witness.

617 Mr. FOWLER: I may say we have shown the error in Mr. Johanneson's testimony as to the Wagner Company's practice as to the cost of apparatus and as to the Wagner Company's selling price. Now, we wish to take this further and show that they are not entitled to this $75,000 on another theory. I think we are entitled to show our theory of this case. I am not familiar with the details of the workings of the Wagner Company, or any other company, as to the way they make up their books and as to the way they charge, and what not. I think I am entitled to show by this witness all the facts as to this 41% and all that. This matter involves this 41%. I don't know about that 41%. It has been worked out by counsel.

The MASTER: In regard to this question as presented, it seems to me to be merely calling for the opinion and argument of the witness to be set against the opinion and the argument of counsel for complainant. He has submitted a computation which he has worked out for the purpose of making his claim clear to the Master as to the amount of the profits for which he claims damages. Now, it seems to me that this is a matter of conclusion to be drawn from the facts, and this witness, as a witness, is not the proper party to draw the conclusion from the facts. He has testified to the facts as he understands them, so far as he has gone. If this question is directed to calling for any further fact from this witness it is competent. But as for calling for his conclusion and argument to offset the conclusion and the argument of counsel for the complainant, it seems to me that clearly the party to make that would be the counsel for the defendant in brief and argument.

Mr. FOWLER: I do not call for any argument by the witness. I think if the witness has any figures or anything from these figures or these statements that have been put in, that he can produce, these facts may throw light on the subject. I do not wish the witness to make any argument against counsel for complainant. That is not the purpose of the question.

Mr. BAKEWELL: I would like to know what fact is asked for by the question. You are arguing the case, and may present certain facts or suggest certain facts to his mind, but the question has not asked for any facts; it calls purely for a conclusion.

Question 233 is here read to the witness.

The MASTER: That, it seems to me Mr. Fowler, gets right back to my ruling. The question is not calling for a fact, so far as I

618 am able to understand it, but is asking for his opinion on the argument of the counsel for complainant. If you insist upon the question in that form I will let it be answered, although I am clear it is incompetent. The witness may answer it however, subject to the objection, so the record may be made clear.

Mr. FOWLER: I am perfectly willing to modify my question and will ask the witness.

Q. 234. Can you refer to any facts or figures which will throw

any light on this subject or which will show this to be accurate or inaccurate?

The MASTER: That will be a form of question for the witness to answer if he has any additional facts.

Mr. BAKEWELL: Show what to be accurate or inaccurate?

Mr. FOWLER: This claim of $75,000 profits based upon the second [*ruce*].

Mr. BAKEWELL: Then it must be confined to whether or not my argumentative conclusion of $75,000 is correct, based on the premises I stated in my statement. Otherwise, the question has absolutely nothing to do with it. It is absolutely an incompetent question. I have gone upon a certain hypothesis, that certain conditions existed, as they did exist upon the record as it was then. Upon this hypothesis you might ask the witness if my figures and conclusions are correct, but otherwise not.

Mr. FOWLER: Haven't I the right to proceed upon that hypothesis and show by the facts and figures you are wrong?

Mr. BAKEWELL: You might show miscalculation, but you must assume that my premises are correct.

The MASTER: The witness may answer the question subject to the objection. Let the question be read to the witness.

Question 233 is here read to the witness.

A. I understand this sum of $75,093.62 to be 41.26% of the total profits of the company over the period of this schedule. I also understand that the counsel for complainant arrives at this per cent. of 41.26 by determining what proportion the transformer business involved in this schedule bears to the gross business of the company as shown for the same period of time. In other words, complainant's counsel makes the assumption that the same percentage of profit was made on all business done by the company during this interval; and, therefore, since the transformer business in-
619 volved in this schedule was 41.26 it is a fair assumption that the profit on the transformer business involved in this schedule was 41.26 of the total amount, or $75,093.62. It is a fact that the profits made on transformers were not identical in percentage of cost with the profits made on the other business done by the company. It is a further fact that no representative of the company in a position to know anything of the facts, ever assumed the profits to be uniform on all apparatus manufactured by the company. During this period, we manufactured, as I have heretofore stated, six or seven lines of machinery. Among them a line of single phase alternating current motors. This single phase alternating current motor line constituted a very substantial part of the total business, and we had no market competition in his line of apparatus; and the profits on that business were, in my opinion, much larger than the profits on transformers.

The facts are, that during the period covered by the schedule of transformers herein listed, the company was compelled to pay a considerable amount of money into the business by virtue of the fact of the cost of the transformers involved in this schedule exceeding

the estimated cost. The total profits of the company not providing sufficient capital to take care of these costs of manufacture.

At this point the further hearing of testimony was adjourned to Monday, November 13, 1905, at half past ten o'clock a. m.

ST. LOUIS, *November* 13, 1905.

Met pursuant to adjournment as above, on Monday, November 13, 1905, at half past ten o'clock, at the offices of Messrs. Fowler & Bryson, in the Commonwealth Trust Building, St. Louis, Missouri.

Present: Mr. H. H. Denison, Special Master; Mr. Paul Bakewell in behalf of the Complainant and Mr. A. C. Fowler in behalf of the defendant; when the following proceedings were had:

The direct examination of Mr. W. A. LAYMAN was continued, as follows:

Q. 235. Are you able to state what was the reason for the Wagner Company using open spaces in the core of an oil filled transformer?

Objected to by counsel for complainant.

The MASTER: It seems to me immaterial, but the witness may answer subject to the objection.

620 A. The only reason I know of was that the introduction of these spacing blocks was a shop convenience. In my previous testimony I have stated that transformers were frequently carried through the shop to partial completion, and then sent back after progress tests had been made, to be built over again, in order to meet engineering specifications.

In the mounting of the laminated iron sheets it was not the practice of the shop to use hydraulic or other kinds of processes in order to clamp the iron down tightly. The shop operatives put on as much iron as they could loosely, by hand, and then in tightening up the iron; afterwards these spacing blocks were inserted in places made for them, by employing an ordinary screw driver as a wedge. The screw driver was forced in between the laminations, and an opening made which permitted the entrance of the spacing blocks, and then by means of a hammer the block was driven in.

In the operation of the transformer there is a strong tendency to mechanical vibration of the sheets of iron, this being an effect produced by the alternating magnetism in the iron. This mechanical vibration would produce a loud hum in the transformer if the sheets were loose, and it was, therefore, always desirable to have the sheets held tightly together. This could have been done by means of a press of some sort, but our practice was to do it mainly by the introduction of the spacing blocks.

When the transformer had to be dismounted for any reason, the spacing blocks were drawn out, and it was then a very simple matter to take off the iron.

By the MASTER:

Q. 236. Were these spacing blocks driven clear through from one side to the other

A. The spacing blocks were short pieces of fibre, usually about the width of the iron segment. If the segment were two inches in width, the block would be two inches; and we would drive it in approximately through the entire width. There was never any clearly defined rule as to the number of spacing blocks to be inserted. The foreman of the department has stated to me he had no instructions on this score at any time.

According to the language of the patent, line 56, the statement is made "Each group of—say five or six—plates thus applied is preferably separated from the succeeding group by air spaces." In our practice these spaces were anywhere from an inch to three inches apart, and the number of plates of iron intervening between the spacing blocks was anywhere from fifty to two hundred. The foreman inserted enough blocks to make the iron tight.

621 My entire time was spent, at that time, on factory work, and what we did in the beginning of our manufacture of oil filled transformers was to take our standard transformers, which we had been previously operating dry, and without any change in it, insert it in an oil filled box. This is the way the transformers involved in the patent in suit were operated.

Again quoting from the patent in suit, at line 70, "Where the converter would be used in the open air, tubes f^1 f^2 would permit a free circulation of air, and thus aid in keeping the converter cool. It may be preferred in some instances to surround the converter with some oil or parafine or other suitable material, which will assist in preserving insulation, and will not be injured in heating."

As I have said, this was exactly our practice. We took our standard transformer, which employed spacing blocks in exactly the same way, and simply put the entire transformer into a box which contained oil.

The patent in suit was drawn to cover——

Mr. BAKEWELL: I respectfully submit that is improper. Here is a question involving simply a question of fact, and here this witness is undertaking to construe the patent; it is a pure argument of the witness.

The MASTER: The Court has construed the patent, or will do so if it has not already been done—I am not entirely familiar with the decree. But I do not think it is competent for the witness to construe the patent.

The facts that were done, of course it is perfectly competent for the witness to state, and what effects were produced by what was done, it is proper for him to state. But it is not proper, I think, for him to construe the patent which is in suit.

A. Our manufacture of transformers at this time was going ahead without any knowledge of the patent in suit. And we continued——

Mr. BAKEWELL: There is another question he is going into, about going ahead without knowledge of the patent in suit.

The MASTER: I think it is immaterial.

Mr. BAKEWELL: It is not only immaterial but the proof in this

case shows going ahead after notice, etc. This does not involve a question of fact, but is all pure argument.

The MASTER: The witness may answer the question, subject to the objection, which I think well taken.

622 A. All the oil filled transformers manufactured by the Company from this date, which was about 1894, up to the termination of the period covered by this schedule in this case, employed spacing blocks in the manner I have described, as a matter of shop convenience, and without any definite rules existing for the use of the blocks. Their use was discontinued at the date specified in the schedule, and has not been resumed, although the patent has since expired.

The shop manner of mounting the iron has been modified, and the iron is now clamped tightly by other means.

Throughout a considerable part of the interval covered by this schedule, there have been eight or ten Companies manufacturing transformers——

Objected to by counsel for complainant, as to what other Companies have been doing.

The MASTER: I think the objection is well taken. I cannot see that the action of other manufacturers can have any bearing on this question, but the witness may answer the question subject to the objection, which I think is sound.

A. (continued). A part of them have employed spacing strips in this manner, and others have not.

Q. 237. When did the Wagner Company first use open spaces in the core of an oil filled transformer?

Mr. BAKEWELL: That is objected it. It seems to me the issue before this Master here is too clear to permit an inquiry of this kind. This question either relates to the invention or the entire combination of a transformer in its entirety, called for by Claim Four of the Westinghouse patent in suit; or it does not relate to the invention the subject matter of the patent at all. It is utterly immaterial, before this Master, as to when the defendant first used a transformer such as the one called for by Claim Four of the patent in suit. We have had from this very witness what he designates as a "schedule," or statement of the infringing transformers manufactured and sold by the defendant during the period covered by this inquiry. Therefore, it is utterly immaterial now, as to when the defendant may have first used this invention. That cannot be of the slightest assistance to the Master. The Court has decided the patent is valid, for a new and useful invention, and that the defendant has infringed it. We are before the Master for the purpose of recovering whatever we may be entitled to recover on account of this infringing. I respectfully submit that it cannot possibly help this inquiry in any way to show when the defendant may have first used this infringing article. We are allowed, under the statute to go back only to a certain date before the filing of the bill, and to that we have distinctly confined ourselves.

623 Mr. FOWLER: If your Honor please, I think we are entitled to show, if it be a fact—I don't know what the fact is—whether or not the defendant has been using the thing for a long number of years, without any suit being brought against them, in mitigation of damages. I think the question is proper.

Mr. BAKEWELL: Now we know what the purpose of the question is, and now it is clearer than ever that it is utterly immaterial and irrelevant to this inquiry, and also it is incompetent.

If it were a fact, which it is not, that the defendant had been using the infringing article without the knowledge of the complainant, for a long number of years before the filing of the Bill, and for a sufficient length of time for the defendant to invoke the doctrine of laches, that is a defense which the defendant could have made before the filing of this case. That is recognized as a distinct defense. It is not a question which goes in the slightest way to the mitigation of damages. We are away beyond that point. The Court has decided that no good defense has been pleaded or made out, and that the patent is valid, and has been infringed, and we are before the Master now for an accounting on this matter of the infringing articles made during the years covered by the schedules to which the witness has referred.

Now we have the statement made by defendant's counsel that the purpose of this question is to ascertain the fact, because if it is a fact that the defendant has been using it for a certain number of years, according to his theory that goes in mitigation of damages. I respectfully submit it does not. We are before the Master as to the apparatus made within a certain period of years, commencing, according to these schedules which he has presented here, June 1, 1896 (which as I recall it is about six years before the filing of the Bill Complaint in this case). Defendant's counsel himself was most strenuous in his objection to going back prior to that time, as Your Honor will remember.

Mr. FOWLER: I simply referred to that statute; that was all. I don't know what the fact is about this matter. In fact I haven't any idea when it was.

Mr. BAKEWELL: It is utterly immaterial whether you have or have not.

The MASTER: It seems to me that as to the period embraced in that schedule, it is admitted the patent was infringed. I cannot see what relevancy it can have to the issue here, to show that the patent had been infringed at another time, or when the use of the spaces in oil cooled transformers was first begun by the de-
624 fendant. It seems to me to be wholly irrelevant; but the witness may answer the question subject to the objection and the ruling.

A. We began the manufacture of oil filled transformers containing spacing strips, according to my best recollection, early in 1894, at which time we abandoned our type of box permitting air ventilation, and substituted for it an oil type box.

Q. 238. Have you ever seen or known of oil cooled transformers

being constructed with open spaces in the core, only. That is to say, not having open spaces between the coils and between the coils and the core?

Mr. BAKEWELL: Objected to and in connection with my objection I ask the Master to examine Claim Four of the patent in suit. Under Claim Four of the patent in suit, as Your Honor will see, it is immaterial whether or not in addition to having a transformer under that claim, the transformer should also have open spaces between the coils and between the coils and the core.

The MASTER: I think the objection is well taken. But the witness may answer it subject to the objection.

A. The only transformer, or the only general line of commercial transformers that I know of, built according to Claim Four, and not employing other features of construction, is a general line built by the Complainant Company in this case. In that line of transformers they did not employ spaces between the coils and the core, or between the coils. The transformers are built, however, with individual coil windings, which are clamped tight together, and the iron laminations mounted snugly around the coils. These coils are then flared out at the end in fan fashion—fan shaped. The cooling of the copper is, therefore, secured by a wide exposure of surface at the ends of the transformers. The individual, fan-shaped sections, as they are sometimes called, being flared at varying angles, so as to in a sense resemble the ribs of a fan when the fan is opened out.

Our company has never built anything of that kind, we always laying great stress on the separation of the coils from the iron, and the separation of the individual coils from each other, so as to permit the very free circulation of air or oil which ever type of transformer it may be, in and around the entire surface of the coils.

Mr. BAKEWELL: I object to that answer as absolutely incompetent. The witness undertakes to state that the complainant has built a certain type of transformer, which he undertakes to describe.

625 The MASTER: The objection to the question has already been sustained.

Mr. BAKEWELL: If the answer were otherwise relevant and material, this part of the answer would be irrelevant and immaterial.

Mr. FOWLER: I want to except to that ruling. I should like to say something further.

The MASTER: You may do so.

Mr. FOWLER: The question is put with the idea of meeting the contention of the complainant that these open spaces in the core are the great thing in the transformer; and that, as a matter of fact, transformers are not built having only those open spaces in the core.

The object of this testimony is to show, that the spaces in the core are not controlling, and not important, and are of subsidiary utility, only. I think the question and the answer goes to the extent of the

utility of the invention in this case. I understand complainant's counsel to admit by his last statement, and the fact is, that the Court in this case (Judge Adams) has decided that Claim Four does not cover a transformer which has open spaces between the coils and between the coils and the core, if it does not have open spaces in the core. I think the question goes to the extent of the utility of this Claim Four.

The MASTER: I understand, of course, that your view upon this is, that the extent of the utility of it may be shown by the defendant, for the purpose of mitigation of damages. While I have my doubts about the propriety of that method of defense, still, while expressing my attitude or sustaining the objection of complainant's counsel, I will allow the question to be answered; so that I may have an opportunity of correcting my error, if I am in error, which I could not do if it do not enter the record, because I could not be expected to carry these things in my mind.

Counsel for defendant notes an exception to the ruling.

The MASTER: I understood that in all these matters, throughout this record, that exceptions were preserved by agreement. Was not that the case?

Mr. FOWLER: I don't know how that was.

Mr. BAKEWELL: I do not recall an agreement of that kind.

The MASTER: I am quite sure I announced that as my understanding.

626 Q. 239. What would be the commercial value of an oil filled transformer, having open spaces in the core, only, and not having open spaces between the coils or between the coils and the core, or some provision for keeping the coils cool?

Mr. BAKEWELL: That is objected to as utterly immaterial.

Mr. FOWLER: I would repeat the same remarks I made as to the last question.

Mr. BAKEWELL: If by that question counsel means to ask, what would be the commercial value of the invention the subject matter of Claim Four of the patent, when that invention was present in a transformer which does not also have open spaces between the coils and the core, the question is objected to as utterly incompetent, irrelevant and immaterial.

In the first place, the drawings of the Westinghouse patent in suit clearly show that there is a space between the coils and the core. Whether there be a space between the coils and the core is utterly immaterial to any inquiry in this case. Claim Four covers a combination, specified therein, having certain elements. And it is clearly broad enough in its scope to include a transformer which may or may not have the additional feature, illustrated clearly in the drawing of this patent, of having spaces between the coils and the core.

If the question is asked for the purpose of showing that there is no commercial utility in the thing claimed by Claim Four, then I respectfully submit the question is not a proper one, because the defendant is estopped from taking that position and the courts

have already declared that the invention, the subject matter of Claim Four, which the defendant has infringed, is a new and useful invention.

Mr. FOWLER: Counsel for complainant is entirely mistaken about the patent in suit showing spaces between the coils and the core; and the Court in this case distinctly held (Federal Reporter 129, page 607) "Third: The defendant's device also has certain open spaces between the core and the coils, as shown in its model in evidence; the complainant's device has no such spaces". I submit Counsel is in error.

Furthermore, the Court says in this case, at page 605, as to spaces between the coils, "First: The fact that there is a space between the two coils when inserted in the core is not an infringement of Claim Four, for the most obvious reason that Claim Four calls for no such space, and for the quite equally obvious reason that Claim One, which is not now in controversy, does contain that element."

Mr. BAKEWELL: This is simply for the purpose of causing
627 confusion. Counsel knows better. The structure in that case is not before the court at all, and was one [*one*] which the court said did not infringe the patent. That is about another form of device before Judge Adams, and which His Honor held did not infringe the patent in suit.

When he speaks of it not having such spaces he speaks of defendant's structure which the court held did not infringe. He is not concerned with the transformers which we have before the Master on this accounting. It is perfectly true that Claim Four of this patent does not claim spaces between the coils and the core. That is true. But I say that is utterly immaterial. I say the transformer may or may not have spaces between the coils and the core, and, nevertheless, infringe Claim Four; and it is only necessary for your Honor to look at Figure 1 of the patent in suit to see that there is illustrated there, for that matter, spaces between the coils and the core.

The Master here examines the drawing.

Mr. BAKEWELL: I understand from that view that there are spaces between the coils and the core here and here (indicating on drawing). It is perfectly plain. But this is utterly immaterial. This very Court has found it so by holding that defendant's infringing transformers infringed Claim Four, and it is utterly immaterial whether transformers having in their construction Claim Four of the patent in suit, had in addition spaces between the coils and the core. This is mere sophistry. It is an attempt, which has been repeatedly made in this case, to confuse the record and depart from the very, very clear issues which are before the Master, and ring in something not inquired about in this case at all.

Mr. FOWLER: Here again Complainant's counsel is in error. All the defendant's transformers before the court in this very case, had open spaces between the coils and between the coils and the core. Defendant did have one form of transformer which had no spaces in the core, and that was the only modification in that device, as compared with the other devices of the defendant.

Now I understand counsel for complainant, in a previous objection, has substantially admitted, and it is unnecessary for him to admit it, because the Court has decided it, that Claim Four does not cover a transformer having open spaces between the coils and between the coils and the core. That is merely and solely
628 directed to the open spaces in the core.

Now, then, in view of the last objection, to intimate that it not only includes the open spaces in the core, but includes the spaces between the coils and between the coils and the core, I cannot understand where we are in this case. This thing has been specifically ruled on by the Court.

Mr. BAKEWELL: I have not admitted that a transformer which has spaces between the coils and the core does not infringe the patent, if that transformer also had embodied in its construction the construction of Claim Four. In other words, if such transformer, having spaces between the coils and the core, as the very structure illustrated in the patent shows, but also has spaces between the core, and otherwise corresponds with Claim Four, it infringes the patent, and the Court has so declared. Therefore, I have not made any such admission as counsel refers to.

The MASTER: I will allow the question to be answered, subject to the objection.

Q. 239 is read to the witness.

A. If we were manufacturing a transformer which did not contain spaces between the coils and between the coils and the core, and were confining ourselves to the manufacture of a transformer designed according to Claim Four alone, we would be at a very decided commercial disadvantage, and would be compelled to limit our manufacture to very small sizes of transformers. It is the general practice of manufacturers and also purchasers, to lay great stress upon the spacing between the coils. Every manufacturing Company so far has to place the coils outside of the iron.

In the so-called "core type" transformer——

Mr. BAKEWELL: Now he is going into what other manufacturers do. It does not answer any specific question. Every time the witness has a chance, he goes into an argument on what he conceives to be the merits of this case; and I respectfully submit he should be checked.

The MASTER: It seems to me that part of the answer is not responsive, so far as I can see; but the witness may finish his answer, subject to the objection.

A. —were compelled by the market conditions to employ spaces between the coils and between the coils and the core. So far as I recall, we have never received a set of specifications requiring us to employ spacing strips in the core; and since our discon-
629 tinuance of the use of spacing strips in the core, we have not on record the loss of a single sale on this account, or complaint of a single purchaser of apparatus built without spaces in the core.

Mr. BAKEWELL: In order to emphasize the correctness of the

objection which I made to the last question put to the witness, and in view of the nature of the witness' answer, I call the attention of your Honor to the decision of the Circuit Court and of the Circuit Court of Appeals in the Carbide case, both of which emphasize the fact that the invention, the subject matter of Claim Four of this patent, is of great value, and of especial value, as it has been used by the defendant in connection with the large sizes of transformers. Therefore, if this question were relevant or material at all, this witness is contradicted by the findings of the court in its decision in the Carbide case, by which the defendant admits by its Answer it is bound.

Q. 240. Price to the date of the filing of the application for the patent in suit, which is December 27, 1886, are you able to state what was the sizes of transformers made at that time, or prior thereto; that is to say, how large were transformers constructed at the time inquired about?

Mr. BAKEWELL: That is objected to. That is going back to a date prior to the date of this patent, if your Honor pleases, and so, in view of the fact that there has been a finding by the Circuit Court and the Circuit Court of Appeals as the immediate result of this invention. Transformers were made of larger size, could be made of larger size, and with much greater efficiency. All this is going back to a question which, if material or relevant at all, could have been made material and relevant prior to the Answer in this case, and before the final hearing. I submit that is another instance of an utterly irrelevant, immaterial and incompetent inquiry in this case.

Mr. FOWLER: That question as put is directed to the point of the evidence given by the witness, that a transformer built only with open spaces in the core, which we submit Claim Four covers and nothing else, is adapted to small sizes of transformers, and at the time this invention was made transformers were only made of small sizes. They had not attained these very large sizes then. The patentee in this case knew nothing about these large sizes. You will find from the record in the Carbide case, they did not think they could make them large.

Mr. BAKEWELL: How can that question help?

630 The MASTER: It may have some weight which I do not apprehend, to carry out defendant's line of mitigating the damages. It seems to me to be immaterial, but I will allow it to be answered because it may be made clear to me later, possibly.

Mr. BAKEWELL: With your Honor's permission, I want to put on record this further objection I wished to make.

Your Honor must see here is another attempt, notwithstanding the admissions of this Answer, of counsel trying to get over the effect of the estoppel, which must operate on this defendant by virtue of the admissions of his Answer. He is trying to get over the effect of the decrees and findings of the Circuit Court and the Court of Appeals, in the Carbide case. He now undertakes to say that he wants to show by this witness that the patentee of this patent con-

templated only small transformers, because at the date of that patent only small transformers were made.

Now in the first place no such inference can be drawn from any statement made by this most interested witness; and in the second place, it is fundamental, and it has been decided over and over again, that if at the date of the patent the patentee contemplated only small transformers,—there is nothing in the patent to distinguish that. But even if that be true, the courts have decided in respect to inventions, that the inventor often builds better than he knew. In this case the court has declared with respect to Claim Four, that it is a most useful and meritorious invention, and it was one of the things that enabled large sizes of transformers to be built, because it could, by its construction, bring about the complete circulation of oil in the transformer.

Your Honor has ruled, but I simply wanted to emphasize my objection, in view of the statements made by defendant's counsel, trying to persuade your Honor to open up a line of inquiry which, like nearly everything else this defendant has introduced, is only making up a large record, and taking up an immense amount of time. It is utterly immaterial and irrelevant. And, besides that, there is nothing to show that this witness is qualified to state as to transformers away back in 1886.

The MASTER: That is, of course, as to his own knowledge.

Mr. FOWLER: I asked him if [—] were able to state.

The MASTER: If that is within your knowledge, you may answer, Mr. Layman.

631 A. At the date of the application for this patent, or within a year thereafter, I was just beginning my college course in engineering, and the only transformers built at that time, to my knowledge, were transformers of not to exceed five kilowatts capacity; all of which were built without the use of oils; and according to the same construction, generally, otherwise as the construction of the patent. Five kilowatts would be one hundred lights, according to our present standard of rating.

Q. 241. Do you recognize "Defendant's Exhibit Wagner's Transformers, No. 1 and No. 2;" If so, state what they are? These being the Exhibits introduced in evidence in connection with the testimony of Prof. Langsdorff.

A. These are the transformers built in the shops of the Wagner Company, and tested by Prof. Langsdorff.

Q. 242. Please state, if you know, what difference or differences there are between these transformers?

A. The difference between the transformers, or the only difference is, that in the one case the iron is separated in groups by these spacing blocks, and in the other they are not.

I want again to refer to my previous testimony, in this connection, and to the statement I made that our iron is usually separated in bunches of two, three or four inches, depending on the size of the apparatus, making here about one hundred and fifty plates in the bunch, as compared with the statement of the patent of five or six plates being separated in a bunch.

Mr. Johanneson somewhere in his testimony makes the statement that in designing transformers he allowed one-eighth of an inch per inch of iron—or something of that kind—for the introduction of spacing strips. I cannot find, nor did I personally ever know, during my own shop experience, that this was a rule, other than used by Mr. Johanneson for his personal convenience; or that it prevailed in any sense in the practice of the factory, or was done by the instructions of the superintendent, who was also the Chief Engineer.

Our foreman got on a certain number of pounds of iron. Our designs all specified a certain number of pounds of iron, and when this number of pounds of iron was on, the balance of the space, if any, or the tightening up of the plates was done by means of these wedges.

By the MASTER:

Q. 243. When you speak of so many pounds of iron producing so much surface, or so many plates, it makes no difference whether you designate them by pounds or by count, would it, so far as that is concerned?

A. In the standards of the designing department, they determine by experiment in each size of apparatus how many plates of
632 iron would make a pound. In the design of a transformer, the function for determining what the so-called "iron loss" would be, is the cross section of the iron, what it would be in square inches. That is, cut through to the copper. And they reduce that instead of in square inches, for convenience, in quick work, to so many pounds of iron. When the formula called for so many pounds of iron, and the foreman put, in that form of construction, the apparatus on the scale, and when they had on that many pounds of iron they would stop putting on iron.

In the two transformers in question, the iron loss in watts is identical in the two forms of transformers.

In the design of a transformer there is a certain number of watts loss in the iron, a certain number of watts loss in the copper, and according to the standard of quality of the iron we found the watts would run so many per pound of iron, and we therefore put on, say fifty pounds for a certain number of watts loss.

Q. 224. Is there any provision in your transformers, oil cooled transformers, as shown by the two transformers to which your attention has just been called, by which the circulation of oil through open spaces in the core washes, and thus cools, the coils?

Mr. BAKEWELL: Objected to, because these transformers the witness has referred to are transformers which, admittedly, have been made recently, and for the purpose of specific experiments; and, furthermore, this transformer has not open spaces in the coils—at any rate I so understood from the witness.

Furthermore, I object to the phraseology of the question, as there is no such term as "washing" *using* in the specifications of the patent in suit.

Furthermore, if it be attempted by this question to show that the infringing transformers for which the defendant has accounted in

this case do not utilize the advantages of the invention the subject matter of Claim Four, the defendant is estopped from taking that position, the Court having found that such transformers do utilize the invention, the subject matter of Claim Four of this patent, and that it is advantageous.

The MASTER: The question may be answered subject to the objection, which I think is well taken.

A. In the construction of both of these transformers as in the construction of all the transformers in the schedule in this record, the Wagner Company has introduced around the coils protecting plates of insulation, which cover substantially all the surface of the coil in contact with the iron, or exposed to the iron, on the
633 side of the iron, and any oil which might tend to enter these pockets would not touch the coils of the transformer——

Q. 245. Specify more clearly what you mean by "pockets" of the iron?

A. By pockets in the iron I mean spaces in the laminations by the introduction of the spacing blocks. That becomes in the transformers in this record, a pocket rather than a channel for the circulation of the oil. These insulating strips effectually prevent the oil coming up through and against the windings.

In the construction of apparatus of this kind, it is very important to have the insulation between the coils and the iron of the highest possible amount, so that lightning will not necessarily puncture the insulating. These pieces are usually called in the factory "corner pieces." The corner of the coils being the point where the first danger of injury comes.

In mounting these plates of iron on the coils, the coils are set up forward, in the position in which they here appear (indicating). The lower casing is put on, and then the shop mechanic begins to lay these sheets of iron around the coils and as they come up, by means of mallets or hammers they keep those plates as uniformly perpendicular as possible. And in that hammering process, without the use of these corner strips there would frequently be cuts on the coils. These strips are always introduced to avoid that danger, and in practically all sizes of transformers in this schedule, they almost completely surround the entire coil. In the small sizes they always did entirely surround the coils; and the coils were, therefore, not reached by the oil through the iron; but the circulation of oil comes up from the bottom, between the channels in the coils, and between the coils, and these plates.

The ineffectiveness of the oil in lowering the temperature of the coils in this particular transformer which embodies the invention the subject matter of Claim Four of the patent in suit, as also in the Carbide transformers, which run up to fifteen hundred kilowatts capacity is due, in my judgment, to the fact that the oil in this box stands there idle, without circulating, and does not serve a cooling function.

We have found that the iron being exposed laterally conveys its own heat very rapidly to the oil; and the bathing of the iron on the outside by the oil, keeps the iron cool; while the oil coming up be-

tween the coils and between the coils and the iron, keeps the copper cool.

If a transformer were built so that the coils occupied the entire space in the opening of the iron, as shown in the drawing of the patent in suit, and the coils were exposed to the oil at these pockets or these spaces created by the spacing blocks, there might be
634 some cooling of the oil and the copper, which we fail to get, however, in the construction we have always employed.

In the carbide transformers, which were the largest transformers the Wagner Company has ever built, having a capacity of fifteen hundred kilowatts, which is the equivalent of thirty thousand incandescent lamps, we made exhaustive and very thorough tests to determine whether the transformers operated at a higher temperature without the spacing blocks than with the spacing blocks; and we were not able to measure any difference; and the removal of the spacing blocks was entirely satisfactory to the customer. We removed those spacing blocks at considerable expense, but without any permanent injury to the apparatus.

Mr. BAKEWELL: I object to the testimony of this witness in regard to the Carbide transformers, and all this argumentative matter he has put upon the record in reference to the patent in suit, as incompetent, irrelevant and immaterial; and insofar as he undertakes thereby to show that the infringing transformers he refers to, the transformers made by the defendant in infringement of the patent, including the Carbide transformers, were not operated on the principle of the patent, do not have the advantages of Claim Four of the patent in suit, etc., I respectfully submit that these statements of this deeply interested witness should not be considered, not only because of the interest of the witness making them, but because by making them the defendant is undertaking to overcome and contradict the express findings of the Court in the Carbide case.

Q. 246. Please now refer to Complainant's Exhibit Westinghouse Model, a model of Complainant's transformer introduced in evidence in this case by the complainant in its testimony for a final hearing, and state whether or not that construction is such as to allow the circulation of oil through the open spaces in the core to wash and thus cool the coils; And please explain your answer.

Mr. BAKEWELL: That is objected to. That is an illustrative model, showing the invention of Claim Four of the patent in suit. There is no dispute here as to the operativeness of that invention; so it is utterly immaterial whether or not the witness answers the question in the affirmative or in the negative.

Furthermore, the phraseology used by defendant's counsel is simply his own statement, and not anything found in the patent. There is nothing found in the patent about washing with oil.
635 Furthermore, it will be utterly immaterial for the purposes of the inquiry before this Master, whether or not that particular model illustrated the invention the subject matter of this patent, the courts having already held that the invention the subject matter of Claim Four of this patent is new and useful, and does operate in

the manner set forth in the specifications, and form- a new and useful result.

Mr. FOWLER: As Complainant's counsel is so technical, I will modify my question and strike out the word "wash" and limit it to the circulation through the open spaces in the core.

Now, if your Honor pleases, on this question it goes again to the extent of the usefulness to which we have employed this invention, and goes to the mitigation of damages. Here is a construction that we claim will cool the coils by the circulation through the spaces in the iron, and in our construction we claim that any circulation which takes place through the open spaces in the core will not cool the coils. That is the purpose of this question. I think it is entirely relevant and entirely material. But the attitude of counsel for complainant all through this hearing seems to be that he wants as little light as possible shed on the usfulness of this invention, and wants to take it for granted that it is a most useful invention, and that by reason of this he is entitled to all the profits that were made on the construction of the transformers; the plates, the windings of the core, putting spaces between the coils and the core, and between the coils. He says it is by reason of these open spaces in the core that an oil cooled transformer is entitled to everything.

We submit that we are entitled to show that these open spaces as we have employed them, do not contribute to as great an extent, if you please, to the success of our transformers, as contended for by counsel for complainant. That is the whole point.

The MASTER: It may be, from defendant's standpoint, that this has some bearing upon the matter of the mitigation of damages, although it seems to me to be irrelevant, and the witness may answer the question subject to the objection, which I consider to be well taken.

A. In the complainant's model there is one feature of construction in the transformer which, so far as I am aware, has not as yet been brought out; and that is, that the coils are actually up against the iron; and there was a specific object in building the transformer in this fashion. That construction has enabled them to secure the maximum efficiency in the performance of this transformer, by employing as nearly all of the space in the opening of the iron
636 as can be employed for the introduction of copper. All transformer designers recognize the desirability of using absolutely every bit of space in the opening of the iron for the introduction of copper. If the transformer can be so built, and be operative—I mean by "operative", so as not to burn itself out from inability to keep the heat from the copper. As I understand this model the coils were intended to be placed as shown in the drawings of the patent, putting all the opening that is in them immediately between the two windings. In that way they probably got ten or fifteen percent more copper in the opening of the iron than is secured in the model of the defendant company in this case. We sacrificing the case to keep the copper cool by circulating up from the bottom. Now with the coils up tight against the iron, the oil

flowing into these open spaces comes in contact with the copper, and would have some effect in taking out heat in the copper of the coils.

How far the construction of complainant's model could be carried, without the introduction of spaces between the coils and the iron and the coils themselves, without running into the objection I speak of, not being able to carry away the heat, I am not able absolutely to state. But up to a size of say twenty-five kilowatts it might be, and probably would be, that the construction shown by the complainant's model, together with the exposed ends of the winding, take away the heat of the copper in the coils. But I do not believe this construction would suffice for the construction of a fifteen hundred kilowatts transformer.

Mr. BAKEWELL: I hope your honor observes how this witness goes every time into an argument. We are not talking about a fifteen hundred kilowatts transformer.

The MASTER: That was an expression of opinion which was not called for in the question.

Q. 247. Has the complainant in this case any other patent suit pending for infring-ment of any of its other transformer patents, for using oil cooled transformers involved in the schedules which you have submitted, in which they claim profit was made and in which they ask that the profit so made be paid over to them?

Mr. BAKEWELL: I cannot conceive of a more incompetent, irrelevant and immaterial question than this. In the first place, it is incompetent, because if there are other suits in regard to this matter, the record itself is the best evidence of it.

In the second place, it is utterly irrelevant and immaterial to this case whether or not the complainant has any other
637 suits pending against this defendant in regard to any other infringements.

I don't know anything about it, as a matter of fact, but I can conceive how it might possibly be true that the complainant company might have a particular patent on a particular way of winding, which the defendant might or might not have used and infringed, and that would be entirely apart from the question of whether or not the defendant had used, as an entirety, the invention the subject matter of Claim Four of the patent in suit.

I submit this is another illustration of the fact that my objections, rightly or wrongly I conceive them to be, are well taken. But defendant's counsel is not asking this witness a single question on this case, which has anything to do with the question before the Master. I respectfully submit this question should not be asked and an answer should not be permitted.

Mr. FOWLER: In the case before your Honor it is not plain that the complainant is entitled to all profits which we have made on the manufacture of transformers listed in these schedules. We submit that it is relevant and material for us to show that the complainant has another patent suit brought on some of these very transformers, in which they claim they have been greatly damaged and that they are entitled to all profits. It is clear they cannot col-

lect the profits twice. Let us take the complainant at its word, that it is entitled to all the profits in the other case, or that it is entitled to some profits in the other case; then it is surely not entitled to all the profits in this case. Here is the same complainant running two patent suits——

Mr. BAKEWELL: There is not a particle of proof that the complainant is running two patent suits.

Mr. FOWLER: I must make my position clear to the Master. The complainant is not entitled to double profits. If they are entitled to profits in this case, that other suit may be in mitigation of it. It goes to show they are not entitled to all the profits.

The MASTER: Whether or not, that would be open to proof in that way, it is very clear to me that that is not the way in which to show that there is another patent suit pending between the same parties, covering the same construction.

Mr. FOWLER: I could submit a certified copy of the Bill of Complaint in that case, if your Honor wishes it.

638 The MASTER: I think if you wish to establish that fact, from your standpoint, that it should be done in some such manner. It seems to me this is not the way in which to prove a matter of record.

Mr. FOWLER: If your Honor pleases, that suit, as a great many of these patent suits, is not brought directly against this defendant. It is not against the Wagner Electric & Manufacturing Company in name; but it is alleged in this bill that it is against these transformers; and I wish the witness to say whether or not any of the transformers involved in these schedules here are involved in that suit. I can submit a certified copy of the Bill of Complaint in that case.

The MASTER: I think that some such method would be the proper way. It seems to me incompetent to undertake to get this kind of testimony from a witness orally.

Mr. FOWLER: But your Honor does not rule that this witness does not know that the transformers involved in that suit are not included in these schedules. I cannot submit any proof in regard to that except oral testimony. I will follow this up by submitting a certified copy of the Bill of Complaint in the case referred to.

The MASTER: If you will bring the matter before the Master in what I conceive to be a proper method of establishing a record, and supplement this question by such proof, the witness may answer the question subject to the objection, which in my opinion is well taken.

Mr. BAKEWELL: I wish to call your Honor's attention to some things, in view of Mr. Fowler's statement: Suppose Mr. Fowler were to produce here a certified copy of a bill in equity in a case brought by the Westinghouse Company against John Smith—what of that? How could that affect this accounting? They would have to show the condition of that case, non constat the plaintiff has recovered or will recover in that case, or may never recover. Certainly that suit cannot be in respect to the invention claimed by Claim Four of this patent, because there cannot be two patents for the same invention.

Mr. FOWLER: I am not saying that.

The MASTER: It might be that a recovery in this case would be res adjudicata in the other suit. I cannot tell anything about it. I don't know exactly what application counsel for defendant expects to make of this testimony; but I adhere to my ruling heretofore. It seems to me entirely irrelevant but the witness
639 may answer the question with the understanding that the record testimony will be brought in to supplement the answer of the witness.

Question 247 here read to the witness.

A. There is another suit brought by the complainant company in this action, against the Montgomery Electric Light & Power Company at Canajoharie, N. Y. In that suit complainant asks for an injunction and an accounting as to profits and damages on a certain list of transformers, which transformers appear on the schedules in this case.

On page 169, of these schedules, general order No. 7884. The address of the Montgomery Electric Light & Power Company is given in this schedule as New York City, N. Y. I understand they have what they term their general office in New York City, but their plant is located at Canajoharie, N. Y. And the transformers shown in general order No. 7884 in this schedule are in service at Canajoharie, N. Y. These transformers are claimed by the complainant company, in that action, to infringe a patent owned by them, which covers the transformer in its entirety, both as to the principle employed and its method of use. As stated, the transformers are the same transformers in that action as those covered by general order No. 7884 in this action. When the suit was brought against the Montgomery Electric Light & Power Company that company made no appearance, and at my request patent counsel for this company wrote to the attorneys for the complainant company inquiring whether the action was directed against transformers built by the Wagner Electric Light & Power Company, and reply was received that the action was so directed——

Mr. BAKEWELL: That is objected to: If there are letters between the counsel, the letters are the best evidence.

The MASTER: That, of course, is true. The objection to the witness stating the contents of letters passing between other parties is correct. It is not proper for the witness to state what those letters contained.

A. (continued.) I wanted to state the fact that we made inquiry through the proper channels as to whether this suit was directed against the Wagner Company——

Mr. BAKEWELL: Now stop. You have testified the way you did it, and that is the only competent evidence.

The MASTER: That is proper.

640 A. (continued.) I want to add, that on my personal instructions counsel for the Wagner Company assumed the

defence of that suit, and the Wagner Company is the real defendant in that action.

Mr. FOWLER: I can refer your Honor to the Federal Reporter containing the decision given in this case, if you will take judicial knowledge of it.

At this point recess was taken until two o'clock p. m.

After recess on Monday, November 13th, 1905, the following proceedings were had:

Defendant's counsel states that he was unaware that he had in his possession a certified copy of the Bill of Complaint in the case of the Westinghouse Electric & Manufacturing Company against the Montgomery Electric Light & Power Company, the case referred to by the witness, but finds upon searching through the files in that case a certified copy of the Bill of Complaint, in which the allegation is made that the transformers complained of——

Counsel for complainant objects to counsel for defendant reciting what the Bill of Complaint alleges, as it has not been introduced in evidence, and the Bill of Complaint is the best evidence of what it contains.

The MASTER: I think the counsel has a right to frame his statement as he pleases.

Mr. FOWLER, continuing: —were purchased directly or indirectly from the Wagner Company, a corporation organized and existing under the laws of the State of Missouri, and defendant's counsel offers and puts in evidence said certified copy of the Bill of Complaint and asks that the same be marked "Defendant's Exhibit Certified Copy Bill of Complaint Montgomery Case."

Counsel for complainant objects to this statement of defendant's counsel as to what the bill in equity which he proposes to introduce in evidence shows; and objects to the introduction of the said bill in equity, on the ground that the same is irrelevant and immaterial to any issues in this case.

Counsel for complainant objects to the introduction in evidence of said bill in equity on the ground that the same is utterly irrelevant and immaterial to any issues in this case.

Counsel for complainant, by reference to said bill in equity, calls the attention of the Master to the fact that the said bill in equity is brought against the Montgomery Electric Light and Power
641 Company, merely charging infringement of the letters patent herein named by use of the alleged infringing apparatus; and that recovery is sought in that case against that particular defendant, by way of an injunction and an accounting, only in respect to such infringement by use.

Counsel for complainant also calls the attention of the Master to the fact that it nowhere appears from the allegations of the bill in equity referred to, that it is stated or admitted therein by the complainant that the infringing article there complained of is the infringing article complained of in this action on this accounting before the Master. Or that the infringing article alleged to have

been used by the Montgomery Electric Light & Power Company embodied in its construction all or any part of the invention the subject matter of Claim Four of the Westinghouse patent involved in this present suit. So that the Master can see that this bill in equity shows, if it shows anything, that the Westinghouse Electric & Manufacturing Company, on and after the 8th day of February, 1904, brought its bill in equity against the Montgomery Electric Light & Power Company, charging an infringement by that company by the use of a certain apparatus of certain letters patent granted a certain William Stanley, on or about the 16th day of August, 1888.

Counsel for complainant submits that this bill in equity is absolutely irrelevant and immaterial to any issue before the Master on this accounting.

The MASTER: It seems to me as if that objection is well taken, but it may be introduced subject to the objection, and I will consider it.

Q. 248. In what respect did the other transformers involve in the schedules which you have submitted, differ in construction from the transformers which you have pointed out in these schedules as being sold to the Montgomery Electric Light & Power Company?

Counsel for defendant objects to this question for the reason stated in his former objection.

The Master makes the same ruling as before.

A. They differ in mechanical details of construction in minor respects. All the transformers of the schedule are alike with respect to the features complained of in the infringement alleged in the Montgomery case.

Q. 249. Are you able to state whether or not the Wagner Company oil filled transformers with open spaces in the core, sold in the market for a greater or a less price than the same transformers without such spaces?

642 Counsel for complainant objects to the question. Furthermore, it does not appear from the testimony of this witness that any of the so-called Wagner oil filled transformers without open spaces in the core were made and sold by the defendant prior to this infringement. It is utterly immaterial, it seems to me, whether or not the so-called Wagner oil filled transformers without open spaces in the core sold at a greater or a less price than those with the spaces in the core, so far as any inquiry into the profits made by the defendant is concerned. If it were a matter of damages it would be another proposition.

Counsel for defendant states in reply to the first objection, that the Court in this case has specifically found that the defendant had been selling for eight to ten years oil filled transformers, or oil filled transformers without open spaces in the core. And that he did not, therefore, think it necessary to establish before the Master any such fact.

It seems to me, your Honor, that this question is relevant and

material in that it will tend to show what commercial advantage, or to what extent the invention of the patent in suit has commercial advantage. Now if this oil filled transformer with these open spaces in the core is such an important feature, it would necessarily follow that a transformer provided with such spaces would sell for more in the market. If it was essential to the operation of a transformer, it necessarily follows that they would command a high price in the market.

Mr. BAKEWELL: I wish to call attention here to a matter that is exceedingly important. The gentleman is again stating something that tends to confuse the mind of the Master, when he states that the Court has found that the defendant had been selling for eight to ten years oil filled transformers without open spaces in the core. The fact of the matter is, as the record in that case before the Circuit Court shows, that this particular form of transformer, without open space in the core, the Court found did not infringe the patent, was a transformer designed and gotten up subsequent to the date of the patent in suit. This is material, especially in the light of this question, for this purpose, for the question of an important step in advance, or no step in advance, comparison must be made with a thing in existence prior to the date of the patent, and the patent itself, and not with respect to something that is designed and gotten up afterwards.

Furthermore, if it be a fact that a transformer with open spaces in its core did not sell for more than a transformer without open
643 spaces in the core, that therefore that establishes that there was no improvement in the transformer with open spaces in the core. I respectfully submit that is non sequitor; it might have been sold at the same price. This very witness has told us that in selling these particular transformers he was governed by the competition. Suppose the complainant chose to sell these transformers, having this invention in it, at the same price, or at a comparatively low price, and that the defendant chose to meet that price. That might very well be, and it would not in any way tend to show that there was no improvement in the transformer with open space in the core. Especially is that true in this case, where we are after it to ascertain defendant's profits and not damages.

Mr. FOWLER: I would like to quote, in reply to that objection, a little sentence from the Court's decision in this case, at page 608 of the Federal Reporter. The Court says: "Again, it clearly appears that the defendant was engaged in making its transformers for some years prior to the hearing of the Carbide case, and that the witnesses in that case knew of this fact. They certainly knew that the defendant was manufacturing a transformer with open spaces between the coils, and a rectangular opening in the core for the insertion of the coils. But no attempt was there made to hold these features to be an infringement of Claim Four of the patent. The complainant there contented itself by claiming the preliminary open spaces throughout the core itself to be an infringement.

Mr. BAKEWELL: That does not negative what I say. Counsel knows perfectly well that the record in this case shows that that par-

ticular type of transformer which Judge Adams held not to infringe the patent, was a transformer gotten up by the complainant after the date of the patent in suit.

Mr. FOWLER: It was manufactured eight or ten years before.

Mr. BAKEWELL: I simply deny that. I simply say that the records show that the transformer which Judge Adams held not to infringe the patent was designed and gotten up subsequent to the date of the patent in suit. And one of the arguments urged by the counsel for defendant in the case before Judge Adams was this: that because the complainant in this case not only knew of the type of transformer before the Court in the Carbide case, but that the complainant must have known of this latter type of transformer, the complainant had not brought in that later type of transformer

644 as an infringing transformer in the Carbide case, and, therefore, the complainant was estopped from claiming this present suit, (the one before Judge Adams) that that type was also an infringement of the patent.

Mr. FOWLER: I was endeavoring to establish from other witnesses how long they had been making this transformer, but your Honor said that was not material. But I endeavored to establish by this witness that they manufactured this type of transformer for eight or ten years.

Mr. BAKEWELL: I say you cannot institute a comparison under the law, between a structure made after the date of the patent in suit, and the structure in suit, for the purpose of showing an advantage. Furthermore, I object to this question as utterly immaterial, whether it sold for less or for more, in a case where we are seeking not damages but the profits.

Mr. FOWLER: I think you will find Professor Gray has testified that such a transformer had been manufactured before the patent in suit.

The MASTER: I think the objection is well taken, so far as I am able to judge at this stage. The witness may answer, subject to the objection.

Counsel for defendant excepts to the ruling.

Previous question read to the witness.

A. One transformer brought the same price as the other, where the only difference was one having spacing strips and the other not having them.

Q. 250. Are you able to state whether removing open spaces in the core, in the oil cooled transformers, by the Wagner Company, or their making transformers not containing Claim Four of the patent in suit, affect the market demand for transformers: Said Claim Four being as follows:

"The combination, substantially as described, of an electric converter constructed with open spaces in its core, an inclosing case, and a non-conducting fluid or gas in said case, adapted to circulate through said spaces, and about the converter."

Mr. BAKEWELL: The question is objected to, and I ask your Honor to notice the way in which those questions are put. The questions are put in the present tense, as to whether or not they do now. It

is utterly immaterial whether they do now. It would also be utterly immaterial whether they did during the patent in suit, for that matter, when we are concerned only with the profits made by the defendant on these infringing articles.

645 Furthermore, I do not understand that question. It is put in the alternative form and yet to my mind it does not suggest an alternative thing. The first part suggests not having the invention of the patent in suit, and the second part suggests not having the invention of the patent in suit.

Question 250 is here read.

Mr. FOWLER: I will change the word "affects," and make it "affected."

The Wagner Company made some of these transformers with spaces in them, and in other cases it made them without open spaces.

Mr. BAKEWELL: If I understand the question, I will let my objection stand, but upon my word I do not understand it.

The MASTER: The witness may answer the question.

A. It did not.

Q. 251. Did making oil cooled transformers by the Wagner Company, not containing Claim Four of the patent in suit, which I quoted to you in the last question, increase or lessen the cost of manufacture of transformers?

Mr. BAKEWELL: Objected to as irrelevant and immaterial: If the gentleman had stated the cost of manufacturing specific transformers, without the invention of Claim Four, and then stated the exact cost of manufacturing of similar transformers with the invention of Claim Four, we might have some data which might be more or less useful. Or, if he went further, and showed the respective profits in the one case and in the other. But, as the question is put, I respectfully submit that cannot throw the slightest light upon the question before your Honor, and that is the question of the defendant's profits on these infringing transformers.

The MASTER: The witness may answer the question subject to the objection.

A. I can only compare transformers producing the same results, containing Claim Four and not containing Claim Four. Such transformers cost practically the same amount to build. I do not believe the difference in cost of manufacture in the aggregate of a year's output would be a material amount, and I am unable to say whether it would be in favor of the transformer with Claim Four, or the transformer without Claim Four.

Q. 252. Please refer to Complainant's Exhibit "Westinghouse Model" and state whether it is constructed, mechanically and electrically, in strict accordance with the combination set forth in Claim Four?

646 Mr. BAKEWELL: Objected to as utterly immaterial; and I respectfully submit to your Honor that even if that illustrative model were not in exact accordance, "mechanically and electrically" with the thing claimed by Claim Four, that could not in any way

affect any issue in this case. It is established, and even admitted, that the subject matter of Claim Four of this Westinghouse patent is a new and useful invention, operative and useful, and drawn into extensive use. Even if it were established as a fact that the illustrative model the question refers to, was not an operative structure, and was not constructed, mechanically and electrically in accordance with Claim Four, that fact, even if it be a fact, would not be of the slightest assistance in enabling your Honor to determine any question which is before the Master.

Mr. FOWLER: This question is directed to show, mechanically and electrically, what the combination called for by Claim Four comprises, and I think it is material and relevant, and may be helpful to the Master upon the question of mitigation of damages.

Mr. BAKEWELL: I respectfully submit that cannot be of the slightest assistance to the Master, because there is no such question arising here.

The MASTER: I cannot say at this stage of the proceedings, how that can affect that question. But the counsel may be able to point it out to me, and the witness may answer the question subject to the objection, which otherwise I think well taken.

A. There is one respect, at least, in which there is a material difference between Complainant's Model, and Claim Four, as I understand it. There is nothing in Claim Four providing spaces between the coils, or a space between the primary and secondary coils. And Complainant's Model built to correspond with Figure 1 of the patent has a substantial space between the primary and secondary coils, in this respect employing the subject matter of Claim One of the patent in suit.

Q. 253. Can a transformer constructed in strict accordance mechanically and electrically, with Claim Four of the patent in suit, be definitely distinguished, as an entirety, from the rest of the transformer set forth in the patent in suit, and as exhibited by Complainant's Exhibit Westinghouse Model?

Mr. BAKEWELL: I must respectfully protest here against this line of examination. In the first place, just consider who this witness is. And they are trying to use this witness as an expert, to do what?

To show that the invention, the subject matter of Claim Four,
647 is a new and useful invention? Then how do they do that?

By ignoring the fundamental rules with respect to patents, that it is addressed to those skilled in the art; and the Claim itself contains the words "substantially as described." It seems to me this is almost an insult to the intelligence of the Court. We have had from this witness, practically during his entire testimony, taking up your Honor's time and mine, nothing but going into matters which have absolutely and clearly nothing to do with this case. I object to this. I say the question is incompetent one to be asked of this witness, and it is certainly utterly irrelevant and immaterial to any issue before this Master, on the issues which are sent to him to try on the decree of the court; and in conflict with the very decree of the court by virtue of which the Master is taking this testimony,

which decree holds the subject matter of Claim Four to be for a new and useful invention.

Mr. FOWLER: Replying to the first objection, defendant's counsel states that he is not trying to show by this witness that Claim Four is not an operative structure. The fact is, defendant's counsel submits that the witness is a person skilled in this art, and, therefore, the specification of the patent in suit is as much addressed to him as to anyone. Defendant's counsel submits that even though the Claim does contain the words "substantially as described" it cannot carry into the claim a feature which is covered by another claim of the patent; and this has been decided by the Court (Judge Adams) in this very case. Defendant's counsel submits that the question is competent, relevant and material, and says that this very question has been suggested by the Master himself, throughout the taking of this testimony.

The MASTER: The witness may answer that question subject to the objection of counsel. I don't know that I fully understand it myself.

A. A transformer built in accordance with Claim Four of the patent, can very clearly be distinguished from the Exhibit Complainant's Model, and also from the balance of the patent. The model in question, as stated in one of my previous answers, has a space between the primary and secondary coils, which is a clear distinction from Claim Four, and is a distinctive feature of Claim One.

Claim Four also calls for the use of oil in the combination, which is not required in the balance of the claims. The oil as specified in Claim Four, seems to be peculiarly a distinctive feature between this claim and claims two and five.

This is also a substantial difference between Claim Four and Claim Three.

Claim Four also calls for an inclosing case, a feature in-
648 cident to the use of oil also, and this inclosing case is not specified in any of the other claims, and is not necessary if oil is not used.

Q. 254. Can an operative transformer be constructed, having open spaces in the core, but not having spaces between the coils and the core? I refer to an oil filled transformer?

Mr. BAKEWELL: Objected to, because unless by that question counsel means to refer to a transformer embodying in its construction the invention the subject matter of Claim Four, the question is utterly irrelevant and immaterial to any possible issues in this case. If the question does not contemplate the invention the subject matter of Claim Four, the question is an incompetent question to put, and not relevant to any actual issue now before the Master, since the question of the operativeness or non-operativeness of that invention, to-wit, the invention the subject matter of Claim Four of the patent in suit, has already been settled by the decisions of the courts, by which decision this defendant in its Answer admits it is bound. And also by virtue of the very decree in this case,

holding the invention, the subject matter of Claim Four of the patent in suit, to be a new and useful invention.

The MASTER: The witness may answer the question subject to the objection.

A. I think so. In the small sizes of such transformers the spaces in the core could be quite narrow, without the copper windings getting abnormally heated, as the percentage of the total surface of the copper coils exposed to oil outside of the core (I refer particularly to the ends of the core) would be ample to cool the entire winding. As the sizes increase, and it got up to a very large size, it would be necessary to greatly widen the spaces in the core, so that a sufficient surface of the copper coils would be exposed to the oil coming into the spaces in the core, to effect the cooling of the copper through this means.

Cross-examination.

By Mr. PAUL BAKEWELL:

Q. 255. Are you a stockholder in the Wagner Electric & Manufacturing Company?

A. Yes, sir.

Q. 256. How much stock do you own in that Company?

A. I have a comparatively small amount of stock.

Q. 257. How much stock have you in that Company?

A. I think about twenty-five shares.

Q. Is that all?

A. Yes, sir.

Q. 259. What is your title? What position do you now
649 hold with the Wagner Electric & Manufacturing Company?

A. I have the position of Treasurer and General Manager.

Q. 260. What salary do you receive for your services?

A. I receive a stipulated salary of Five Thousand Dollars a year.

Q. 261. Is the Wagner Company still engaged in the manufacture of transformers which are in all respects like this transformer No. 2, which was introduced in evidence in connection with the examination of the witness Prof. Langsdorff, which is marked "Defendant's Exhibit No. 2, and in which there are no open spaces in the core?

A. We are, yes, sir.

Q. 262. Is the Wagner Company making those transformers I have just referred to, for profit, and selling them for profit?

A. I am not sure about the profit, but we are still making them, and endeavoring to secure profit.

Q. 263. Are you prepared to state you are selling them at an actual loss?

A. I cannot state positively that we are.

Q. 264. But you have undertaken to give your opinion before, in connection with your testimony: What is your best opinion about that, Mr. Layman, that you are selling them at a loss, or selling them for a profit?

A. I think some are being sold pretty close to cost, and some above cost.

Q. 265. Are you selling them at a profit, or at a loss? What is your opinion?

A. I should say we are not selling any of them at a loss but I do not know absolutely that that is the case.

Q. 266. It seems to be difficult to get absolute statements from you, but I want to have your best opinion now: Are you selling such transformers at a loss or at a profit?

A. I think on the apparatus as a whole, we are making a profit.

Q. 267. For such transformers as those which are contemplated by my last question, which your Company may sell during the year 1905, has your Company any system by which you would be able to determine, after the end of this year 1905, whether you had sold those transformers which had been sold during the year 1905, at a profit or at a loss?

A. We have a system by which we can tell on the product in the aggregate, whether it is sold at a profit or at a loss.

Q. 268. You could not tell, except in the aggregate, could you?

A. I cannot tell, except in the aggregate.

Q. 269. You are very positive of that?

A. We do not attempt to tell on the individual sizes.

650 Q. 270. But you have such a system as would enable you to state, after the expiration of this current year, for instance, whether or not your sale of transformers of the character contemplated by all of my questions up to the present time—whether that transformer business has been profitable or otherwise, have you?

A. We have a system by which we know what the aggregate cost of the labor and material of the apparatus is, and we can tell whether we are making any profit in the business as a whole, pretty closely.

Q. 271. On the transformer business?

A. Yes, sir.

Q. 272. How closely would you say? You say "pretty closely."

A. I suppose we would be able to tell within five per cent.

Q. 273. Couldn't you tell more closely than that?

A. No, sir, we could not.

Q. 274. Under that system you refer to, I understand you can determine the profits made on those transformers as distinguished from the profits made on the general business of the Company? Am I correct in that?

A. Yes, sir, I think so.

Q. 275. What is that system?

A. It is a system we now have of keeping track of the total labor and material charges which go into the construction of the apparatus.

Q. 276. How do you get at the cost of the material?

A. All material leaving our stock-room is taken out on requisitions. These requisitions go into our Cost Department and are priced, and a careful summary is kept at all times of all those material slips.

Q. 277. That gives you the data of the cost of the material?

A. Yes, sir, that covers the cost of the material.

[Q. 277]. How do you get the cost of the labor?

A. We get the cost of the labor entering into the job in the same way. Every laboring man in performing his job charges his time on the time slip to this job number. These slips are issued by the foreman, and turned back by the laborer to his foreman, and they go back to the Cost Department, where they are also carefully summarized.

Q. 278. How long has that system prevailed?

A. It has been a matter of gradual evolution during the last three or four years.

Q. 279. Only during the last three or four years? Is that true.

A. Yes, sir, it is a new system.

651 Q. 280. Then you would have charged up against the manufacture of these transformers I have been asking you about on my cross-examination, under this system which you say has existed for the last three or four years, the cost of the material and the labor?

A. Yes, sir.

Q. 281. And how would you get the profits, then, from that?

A. We would superpose on this at the end of the year a percentage to cover general expenses, that expense being arrived at from the expense accounts, as we keep them in the general office.

Q. 282. What percentage would that be?

A. That per cent would be variable, depending upon the amount of business done.

Q. 283. That is just an arbitrary percentage you chose to put upon there, depending upon the amount of general business done?

A. An arbitrary percentage, yes, sir; and it varies with the expense of operating the business.

Q. 284. So you might charge up against this transformer account a loss on the general business, might you not, under this system?

A. A loss on the general business?

Q. 285. Yes.

A. Well, if we were doing our business as a whole at a loss, the transformer department would suffer in its due proportion.

Q. 286. Under that system?

A. Yes, sir, under that system.

Q. 287. Then there is no definite way—or, if there is a definite way I would like you to state it,—how you could determine whether or not this particular transformer business I have been asking you about on my cross examination, had been conducted at a loss or at a profit?

A. Only in the fashion I have stated, could we determine. We would be able to arrive at the net price received by the company in corresponding fashion as we have in these schedules. We would know the labor and material expense, and would know the general expenses, and after we would apportion that over all our business alike, as we do, we could then be able to determine whether there

was any margin on the labor and material, with the expense percentage added, on the net price received for the transformers.

X Q. 288. And under your present system, after you have added a certain amount to the labor and material charge, which you
652 say is an arbitrary amount, gauged by your general business, what else do you do, if anything, in fixing the selling price of your transformer?

A. We do not employ those figures in any sense of the word, in fixing our selling price.

X Q. 289. You do not consider the question of the labor and material, in fixing the selling price?

A. We do not consider the question of the labor and material, in fixing the selling price, but after the selling price is fixed we go back to the other end and endeavor to make the other expense of labor and material.

X Q. 290. You say the question of the cost of labor and material does not enter at all into fixing your selling price?

A. No, sir, we do not employ it at all in fixing the selling price.

X Q. 291. What does determine the selling price?

A. The market price determines the selling price.

X Q. 292. The market price of a similar apparatus made by a competitor will determine your selling price?

A. Yes, sir.

X Q. 293. In every instance?

A. In practically all business.

X Q. 294. Of your business?

A. Yes, sir. If we are able to show a superiority in our apparatus over that of our competitor, we may be able to get a better price; but the amount of that better price is gauged by the amount of superiority we are able to show.

X Q. 295. Does the price at which the competitor sells his goods determine you in making your price, irrespective of what the cost may be to you in making that particular article? Is that true?

A. If we are in a competitive market that is what determines the selling price for us. It is not a desirable condition of affairs, but it is an existing condition of affairs.

X Q. 296. I understood you to say in your direct examination that during the time covered by this accounting, covered by the schedules that you have referred to, certain records were kept which have been destroyed; what records did you refer to there?

A. I referred to a series of job numbers on which we attempted to do just what we are doing in our cost keeping department today; that is, keep a summary of the material employed and the labor.

X Q. 297. When were those records destroyed?

A. They were destroyed—we never kept them any great length of time.

X Q. 298. When were they destroyed?

A. They were destroyed—we would keep those of a year throughout the year, and probably then destroy them. And when
653 the system of that method of attempting to keep the cost of labor and material was abandoned, we burned all of the records.

X Q. 299. When was that system abandoned?

A. That was abandoned—oh, I should say, off hand, five or six years ago.

X Q. 300. You say those records were destroyed five or six years ago?

A. I cannot tell you exactly just when they were destroyed.

X Q. 301. Tell us as nearly as you can. It must have made some impression on your mind.

A. Somewhere between four and six years ago.

X Q. 302. When did you stop making and selling these infringing transfromers accounted for in these schedules here?

A. I do not recall the exact date, but it was the date of the decision in the Carbide case. It is in my previous testimony. It is about the date of the last sale shown on the schedule, which comes down to November 14, 1901.

X Q. 303. Then those records were destroyed about the time you ceased this infringement? Was it?

A. Within a year or two from that time.

X Q. 304. You mean within a year or two from the time of the last date in these schedules here, those records were destroyed?

A. We discontinued our system about that time.

X Q. 305. But I understood you, that the records were destroyed about the time you discontinued the system?

A. Yes sir, and we discontinued that system within a year or two of the last date in these schedules. I cannot give you the exact dates. But the discontinuance of the system was governed entirely by the fact that it was an ineffective system.

X Q. 306. The purpose of that system, however, was to keep as nearly as possible an actual account of the cost of manufacturing these transformers, wasn't it?

A. The purpose of it was to keep an actual account of the cost of labor and material going into the apparatus, employed in the same way we now employ the same information secured under the new system.

X Q. 307. And what was the purpose of keeping the account of the cost of the labor and material?

A. We could employ that same information, if it were reliable, as we now employ it, in arriving at the aggregate results of the department. It furthermore gave us a chance to make some check on the actual labor and material being put into the appa-
654 ratus, as compared with such estimate sheets as have been introduced here as complainant's exhibits A and B in connection with the testimony of Mr. Johanneson.

X Q. 308. In regard to the suit of the Westinghouse Company against the Montgomery Electric Light & Power Company which you testified about, as I understand it, the Wagner Electric & Manufacturing Company has taken up the defence of that suit?

A. Yes sir.

X Q. 309. And the Wagner Company is employing counsel to defend that suit?

A. Yes sir.

X Q. 310. Do you consider yourselves really the defendant in that case?

A. Yes sir, substantially so.

X Q. 311. Does the defendant in that case admit that the devices alleged to have been an infringement of the patent involved in that suit, are in fact an infringement of that patent?

A. We do not.

X Q. 312. You deny that you infringed that patent?

A. Yes sir, we deny it.

X Q. 313. You also, I apprehend, deny that the patent is valid, do you?

A. I cannot say as to that contention; but we deny our infringement of the patent.

X Q. 314. You deny that you have used the thing called for by the patent?

A. Yes sir. The patent may be valid, but our contention is that we do not employ it.

Mr. BAKEWELL: I do not think I have any more questions to ask this witness.

At this point the further hearing of testimony was adjourned to Monday, November 27th, 1905, at half past ten o'clock in the forenoon, then to be continued at the same place.

ST. LOUIS, MONDAY, *Nov* 27, 1905.

Met pursuant to adjournment as above, on Monday, November 27, 1905, when by consent a further adjournment was made to Thursday, December 7th, 1905.

ST. LOUIS, THURSDAY, *December* 7, 1905.

Met pursuant to adjournment above, on Thursday, December 7, 1905, at the office of Messrs. Fowler & Bryson, in the Commonwealth Trust Building, in the City of St. Louis, Mo.

Present: Mr. H. H. Denison, Special Master; Mr. Paul H. Bakewell, in behalf of the complainant; and Mr. Albert C. Fowler in behalf of the defendant. And the following proceedings were had:

655 FERDINAND T. SCHWEDTMAN, a witness of lawful age, being duly produced, sworn and examined in the part of the Complainant, testified as follows:

Direct examination.

By Mr. ALBERT T. FOWLER:

Q. 315. Please state your name, age, residence and occupation?

A. Ferdinand C. Schwedtman; age forty; electrical engineer; residence, St. Louis, Missouri.

Q. 316. Were you ever connected with the Wagner Electric and Manufacturing Company of St Louis, and if so, in what capacity, and when?

A. Yes sir. I was one of the organizers of the Wagner Company,

and was connected with them as general superintendent from the beginning of the corporation, the date of which I do not remember, up to August 1st of this year. During nearly all of that time, that is up to August 1, 1902, I was the general superintendent; between August, 1902, and August, 1905 I was consulting engineer for the Wagner Company.

Q. 317. Are you at present connected with the Wagner Electric & Manufacturing Company?

A. I am not.

Q. 318. Are you able to state whether the Wagner Company had on hand during the period beginning with June, 1896, and ending November 14, 1901, figures to show the cost of manufacturing transformers?

A. It did have on hand cost estimates. I am not aware that it had on hand costs, because I know during that time we attempted at various times very hard to get costs, but never got beyond cost estimates.

Q. 319. Who prepared these cost estimates? [*A.*]

A. During the greater part of that time they were prepared by Mr. Johannessen, or under Mr. Johannessen's directions. Part of the time (and I cannot state exact dates) they were prepared by Mr. Sellinger, the foreman of the transformer department, to whom was transferred part of the transformer business, which was taken away from Mr. Johannessen. And I think part of the time also by Theodore Forster.

Q. 320. Do you recognize the blue print tables which I now hand you, same being marked "Plaintiff's Exhibit Blue Print A," and "Plaintiff's Exhibit Blue Print B;" and if so state what they are.

A. (After examining blue-prints). They seem to be tables similar in character to a number that were prepared by Mr. Johannesen, or under his direction, for the use of his department, and my own use, and that of the office, giving cost estimates of certain sizes and types of transformers.

656 Q. 321. How reliable were the cost estimates which you say were prepared in the Wagner Company's factory, at the time refer-ed to, and particularly the cost estimates prepared by Mr. Johannessen?

Mr. Bakewell: That is objected to as incompetent. I understood the witness to state a moment ago, if I understood him correctly, that they could not give the exact cost; that they did get up these estimated costs, according to his statements. If that be true, I do not see how this question is in any way competent, because if they kept a tabulated statement of the actual cost, as they now try to put it, as dis-inguished from this estimated cost, then there would be something with which to compare this estimated cost, and we would be able to determine whether or not these estimated costs were reliable. But if I understood the witness correctly, and they could not ascertain the actual cost of these transformers during that time, according to his statement, then I respectfully submit the question calls for absolutely incompetent testimony, because there is no way

of gauging or testing the accuracy of the statement of the witness as to whether or not these estimated costs are reliable.

The MASTER: I did not understand the witness to make that statement exactly as counsel puts it.

Question 321 is here read.

The MASTER: If the witness knows, or has any means of knowing, how reliable they were, he may answer that question.

A. I know that the cost estimates were very unreliable, and I base it on the following observations: particularly in Mr. Johannessen's department I had repeated and lengthy consultations with him, showing by the weight of coils, the actual coils (I mean transformer coils) copper as well as iron, that the weights in his tabulated cost estimates were very much lighter than the actual weights.

Furthermore, at the end of the year we never could show anything like the figures that our cost estimates of transformers manufactured and sold should have shown, based on the cost estimates.

My conversations with Mr. Johannessen on that particular point became so strong, three or four times, that I told him plainly that he would either have to see his way clear to being more reliable, or quit. And when I finally became convinced that he was unable to give us anything like reliable cost estimates on the whole line, I took away a great part of his work, quite a part of the line he had in charge, in order to accomplish better results in that part of the department that was left to him.

657 These conversations were not only carried on with Mr. Johannessen, but with Mr. Sellinger; and my comparison of estimated weights, and actual weights, was carried on before my eyes by Mr. Sellinger and his workmen. And that was also taken up at various times with Theodore Foster; and I explained carefully to Mr. Forster that I wanted him to take charge of that particular line in order to get results that we had been unable to get up to that time. I mean, to get a closer comparison between cost estimates, and what we knew by the general business statement at the end of the year to have been our cost.

Q. 322. Please state whether these cost estimates were accepted as correct by the Wagner Electric & Manufacturing Company?

A. We knew positively in the office that they were not correct, but we did not know a way of getting closer to it. I know of cases when these costs would come to me, and I have on general principles added ten and fifteen per cent., stating to Mr. Johannessen that if he figured on twenty per cent I would feel very much pleased if we made five per cent.

Mr. BAKEWELL: I do not understand that.

A. continued. I may have to refer to our practice. Mr. Johannessen, as well as the whole factory, was directly in my charge. The sales department was partly in my charge. In other words, prices to the sales department were quoted either by me, but usually by a committee, consisting for awhile of Mr. Wagner and myself, and later on Mr. Wagner, Mr. Abadie and myself; and later on, Mr.

Layman, Mr. Abadie and myself; and in quoting factory costs, which we invariably called our cost estimates, we were so far off that we often made fun of it. Mr. Johannessen very earnestly came to me, and said, "This is twenty per cent. above the cost estimate," and I said, "I would feel gratified if in the end we would show five per cent.," where he assured me twenty per cent. was added to the factory cost estimates.

Q. 323. Mr. Johannessen testified for the Complainant in this case, Questions 35 and 36, as follows:

"Question 35. During the time covered by this transcript or report; that is to say, from June 24, 1896, up to and including Nov. 19, 1901, what practice prevailed at the Wagner Company in respect to the selling price of these transformers? In other words when it came to the selling price, was it the practice of the Wagner Company to add anything over and above the flat labor and material cost, and that percentage which you have referred to, ranging from 24 to 40 per cent?"

658 "Answer. During the time I was with the company, a rule prevailed, which was to add a percentage of twenty-five to the factory cost, and this rule was always used as a base for ascertaining the selling price."

"Question 36. In other words, by the "factory cost," referred to in your last answer, as I understand it, the practice which you say prevailed with the Wagner Company was to take the flat cost of labor and material, and add thereto a certain percentage ranging from 25 to 40 per cent, the sum of which items represented the total factory cost, and that to that sum twenty-five per cent was added to make the selling price. Am I correct in that?"

"Answer. Yes sir. That rule was used as a base for the selling price."

Mr. Theodore R. Foster, another witness called for the Complainant, testified before the Master in this case as follows:

"Question 38. What, if anything, did you have to do during the term of your employment with the Wagner Company, or during any part of your emplo-ment with the Wagner Company, in the matter of making prices on articles manufactured and sold by the Wagner Company, including transformers."

"Answer. During the existence of the sales organization from approximately May 1st, 1901, until the time I left the employment of the Company, I made quotations direct to the various district offices as well as to the proper parties in the office of the Wagner Company, covering all types or classes of apparatus manufactured and these prices were made up from the actual cost of labor and material which was furnished to me by the engineers in charge of the various departments in which the different lines of apparatus were made, and to this flat labor and material I added the necessary expense to arrive at what was known as the factory cost, which in every case was forty per cent, and to the result was added certain percentages, which were generally 25 per cent, with the exception of switchboard work to which 20 per cent was added, and these prices were

then the prices received by the Wagner Company for the sale of the apparatus."

And Mr. Foster was asked this question by the master, and testified as follows:

"Question 39. How do you account for the difference between 25 per cent added to express the factory cost in the earlier years
659 and 40 per cent being added in the last two or three years? Is that the result of increase of salaries?

"Answer. The result of increase in the business and expense."

What have you to say to this?

A. Mr. Johanneson is utterly mistaken. He cannot be posted as to selling prices; from his answer it clearly shows he is not posted. It is true that so far as the factory was concerned I attempted to systematize things. In other words, I attempted to have them figure certain percentages on what was considered the cost of flat material and labor; and that flat material and labor was estimated entirely; and, as I said before, time and again I proved to the boys that the estimates were not correct.

Now, when it comes to adding 25 per cent, I must necessarily place the business in different sections. Our standard transformers were handled differently from our special transformers. On our special transformers we attempted to get 25 per cent over and above what we considered our factory cost estimates. The selling prices of our standard transformers were not based on cost estimates at all. We knew what the market prices of first class transformers were, and we placed those market prices, prices we could get on a piece of apparatus down; and we attempted to get as close to it, or as much below it, having all the while certain specifications to live up to, as we could.

Mr. Johannessen, and I believe Mr. Foster, had prepared for me not one but a number of papers which showed plainly that in the smaller sizes of standard transformers, our cost—and when I speak of cost I mean our factory cost estimates without anything added to them—were considerably higher than our selling prices. The condition was brought about by the market, and was beyond our own control. If we wanted to sell transformers at all, we had to sell the whole line. We found, and we discussed it at great length between us,—I mean between all the gentlemen, Mr. Johannessen, Mr. Foster, Mr. Sellinger, and Mr. Layman; and it was utterly impossible to make the smaller transformers at the market price and come out even. We all knew that and were sure of it, and felt that we did not want to sell those transformers if we could help ourselves. But in order to sell the larger sizes, we had to sell the whole line.

Speaking of this second section, which I call "special transformers"—and under special transformers I mean here all transformers not included in our standard lines as enumerated
660 in our catalogues and tables—this table (referring to complainant's Exhibit Blue Print B) gives 1000-lights transformers as the largest standard transformer. Above that size we attempted to get 25 per cent over our factory cost estimates, but time

and again we were met by the same conditions that prevailed in our standard line; namely, that we had to go very much below the figure that we should have liked to receive, on account of competition in the market.

In order to save labor to myself, I had in many cases 25 per cent added to the cost estimates on special transformers, and gave those prices to the sales department. Many times, however, they were returned to me for revision, because the selling price fixed could not be obtained; and the fact that I had added this 25 per cent possibly gives Mr. Johannessen this erroneous impression.

As to Mr. Foster's testimony, specified by you, he evidently labors to a great extent under the same erroneous impression. No one had the power to make definite prices, except Mr. Abadie, Mr. Layman, and myself; and the prices quoted in the various sales departments by Mr. Foster, in nine cases out of ten, were only general, rough prices, given to agents as a guidance; and he would usually report back to the office to Mr. Layman, Mr. Abadie, or myself, giving the details of the situation, and telling us what his impression was of how much he could get for it, and leaving it to us to reduce the price quoted by Mr. Foster to an amount that would take the business.

As to Mr. Foster's statement that 40 per cent instead of 25 per cent, was used later on, as a result of increase in the business and expenses, I think he speaks of something he knows nothing of.

We changed our figures from time to time, in an attempt to really cover what we found the year before had been excess of expense, and we could get that only in a very general way. We attempted 25 per cent, and found that our actual expenses were very much higher than our estimated ones. (I mean by expenses, shop costs as compared with shop estimates). And we changed the percentage to be added from 25, higher and higher, up to 40 per cent, in an endeavor to have our shop estimates correspond with our shop expenditures.

I cannot, of course, say whether it was within the dates of this schedule that our percentages added were changed to so very much larger proportion than that given in here (indicating testimony). I know we even changed our whole method of adding expense, adding for awhile a certain percentage of labor only, and a different percentage of material. It is all done simply in trying to
661 get at the end of the year to check our actual expenditures with our estimated expenditures.

Q. 324. Mr. Johannessen further testified for the complainant in this case, before the Master, as follows:

"Question 29: What have you to say, in view of the practice which you have referred to prevailing at the Wagner Company's place of business during the time referred to in my last question, as to whether or not, while you were with the Wagner Company, and during the period referred to, it was possible to ascertain from the records of the Wagner Company the cost of transformers made by that Company, which cost included as you have stated the flat cost of labor and material plus a certain percentage added thereto,

to cover generally the expenses of the business or that proportion of the expenses of the business chargeable to the transformers."

"Answer: It should be possible to ascertain these costs. If the original tabulated sheets had been destroyed, they could arrive at the cost of practically every transformer which appears on the transcript referred to by referring to the inventories of the years included in the same."

"Question 30: What do you mean in your last answer by "inventories" and what was the practice of the Wagner Company during the time referred to and covered by this statement: that is to say, from June 24th, 1896, up to and including November 19th, 1901, in respect to these inventories,—so far as the Wagner Company is concerned?

"Answer: During the time that I was connected with the Wagner Company it was customary to make a record of the manufactured stock and the apparatus contained in the manufactory for the purpose of arriving at the condition or the amount of business done during six months, and these records were taken the 1st of January and the 1st of July every year. The Wagner Company always had a stock of transformers on hand which more or less covered the full line of apparatus manufactured by them; and in working up these inventories it was necessary to price the transformers at their factory costs."

"Question 32: Would these inventories show the cost of the transformers (assuming, of course, that they have been kept), made and sold by the Wagner Company during the period of time which I have referred to; that is to say, from June 24th, 1896, up to and including November 19th, 1901, and by cost I mean the cost of making these transformers, including flat labor and material plus the percentage added thereto to cover the other expenses of the business chargeable to the transformers?"

"Answer. The part of the inventory which I had to do with gave the factory cost of the transformers."

662 "Question 33. And by factory cost you mean the flat labor and material plus that percentage?"

"Answer. Yes sir."

"Question 62. The total costs, you say, were sent to the office?"

"Answer. Yes sir."

"Question 63. And they were kept in the inventories, were they?"

"Answer. No, not necessarily. The costs that appear in the inventories are the cost of transformers or parts of transformers which they had on hand when the inventories were taken. As a general rule, the Wagner Company had a large stock of transformers on hand, till they covered nearly the whole range of their manufacture. It would be possible, by reference to the inventory, to get at the cost of the various transformers made."

"Question 64. So it was possible, by referring to the inventories, to get at the cost of the various transformers made?"

"Answer. Yes sir."

"Question 65. On these occasions when you had reason to refer

to the inventories for the purpose that you have stated, did you find that the inventories gave you the data you were looking for?

"Answer. Yes sir. It was usually that I looked for some piece of apparatus or transformer that was on hand at the last inventory and I wanted to price it the same as it was priced the previous time."

"Question 66. You would find the price or cost of that particular part of apparatus in the inventory, would you?"

"Answer. Yes sir."

Mr. Theodore R. Foster has testified to substantially the same effect, but not with as much particularity or great length, on these points. I ask you what you have to say to this testimony?

A. During all these answers Mr. Johannessen labors under the same misapprehension. And by knowing the man it is not at all difficult for me to account for it. He is a very conscientious man, very theoretical, an expert in figuring and tabulation, and has about as little practical judgment as most men of that type have. In my experience with him for years I had the greatest difficulty to convince him that he ever could be wrong. He appreciated that results might have been entirely different from what he foresaw, but instead of applying his mind to remedies, he would use all his ingenuity in finding a reason why it was not his fault that always his judgment did not come out.

663 Now referring to question 29 and his answer, he stated that he only added that cost estimates and not costs, and he evidently confuses those two expressions. I have already explained why I know that the cost estimates were not correct.

He then refers to the inventories, and he is correct that it was the practice for the Wagner Company, annually or semi-annually—I say that because I do not, from my own definite knowledge at the present time know that we in each case made semi-annual inventories during the period specified. But it was customary to make those inventories. The items which Mr. Johannessen gives as costs in these inventories are again only cost estimates, because in pricing transformers complete or in part, we use the same figures, although not priced in the same department; namely, under Mr. Johannessen's directions, in the transformer department, and any error that might have existed in our cost estimates used for every day selling necessarily occurred in our inventories; so that our inventories for a long while were considered among ourselves as only a comparison from one half year to another, because you can readily see that any arbitrary value we might wish to give any part of that inventory, if it kept up that arbitrary value from year to year, it would necessarily give us a means of some sort of measurement. I explain that in a practical way: say, for instance, this length of this page (indicating sheet of paper) is a certain proportion of the width of the page. We might call this one inch. It is not an inch, but we might, for the sake of comparison with the length, call it one inch. And if it is one and a half times as long, call the length one and a half inches. For the sake of comparison, that measurement will serve as well as an-

other, although it is far from being the correct measurement, so far as it could be applied to general measurements of any other article.

In question 32, and the answer thereto, the same misnomer occurs, namely, these factory cost estimates, instead of costs. And this statement holds good as to question 33, and the answer thereto.

In the question and answer 62, Mr. Johannessen states that the costs were sent to the office. I again wish to call attention to the fact that it is cost estimates.

In answer to question 63 Mr. Johannessen states, "As a general rule, the Wagner Company had a large stock of transformers on hand, until it covered nearly the whole range of their manufacture." I think by referring to these inventories you will find that the inventory usually carried what we could not sell, and the inventory from year to year carried the same identical transformers.

664 For some reason or other, it was not quite up to date, and was kept there in the hope of finding a purchaser for it some time or other. In other words, the larger percentage of it was not stock that changes from one inventory to another, but a large part of it was the same identical material.

He states, "It would be possible, by referring to the inventory, to get at the cost of the various transformers made." I simply repeat what I said before, that on account of the fact that Mr. Johannessen deals entirely with cost estimates, it would be just as impossible to get the cost of the various transformers by referring to the inventory, as it would be by referring to the cost estimates.

Mr. BAKEWELL: I object to this witness testifying what would be possible or impossible by getting at the inventory. He has just stated a moment ago, and it is the first time that any witness has so stated, and he has made the direct statement that the inventories are in existence. If they are in existence, they are the best evidence of what they show. I should be delighted to have them produced. Mr. Layman has testified that they did not exist.

Mr. FOWLER: I beg your pardon.

Mr. BAKEWELL: In his direct examination he stated that there was not any record of the Wagner Company by which he could get at the exact cost of manufacture. If those inventories are in existence, they should be produced, to show whether or not he was stating the truth in that record. This witness is stating what those inventories contain.

Mr. FOWLER: That is far from stating that the inventories are not in existence.

Mr. BAKEWELL: If you are relying on those inventories you had better produce them.

The MASTER: The witness has gone somewhat beyond the question in stating an expression of opinion. Of course the proper weight will be given to that.

But I would like to ask the witness one question with regard to these blue prints, which you examined.

Q. 325. Complainant's Exhibits, Blue Prints A and B, as they are called, estimated manufacturing costs, and one of them is dated June 26, 1900, and the other one July 31, 1900; can you tell me whether

those tabulations are intended to apply to the manufacture of the previous month or are they estimates of what the cost will be for the coming month's manufacture; in other words, are they the
665 estimates of what has been done, or are they estimates of what the cost will be to do something in the future?

A. They are, and always have been, of what we expected the cost to be in the future.

Q. 326. In the future?

A. Yes sir.

Q. 327. And those estimates are based upon the cost or estimated costs, of material?

A. Yes sir. The cost of materials was taken in an arbitrary way, because we could not possibly change our estimates from day to day. It is a large job to tabulate such results as you have there before you, your Honor, and we would take, for instance, certain copper prices, and likely keep the same copper prices for some years, so as to simply have a relative knowledge of what our copper and material would amount to, by making various changes. In other words, let us take it for granted that we took fifteen cents, which I am pretty sure is the figure we took for a number of years, regardless of the fact that copper might have been up to seventeen or down to thirteen cents. But we knew, for instance, that by referring to one of these tables here, one secondary coil cost ninety-four cents, with copper at fifteen cents. Now the next estimate might have increased or decreased the amount of copper, and thereby this figure of ninety-four cents might have changed to a dollar or it might have changed to seventy-five cents. We had to bear that always in mind that our copper price was an arbitrary one, and that relatively one estimate with another had value, and would not be so much an indication of what could positively be done at that particular time.

Mr. FOWLER: Did you finish your previous answer?

A. No, sir, I had not gone clear to the end.

The MASTER: I beg your pardon. I should not have interrupted, but I thought you had finished.

A. (continued). In questions 64 and 66, and the answers thereto, Mr. Johannessen conveys the idea that by referring to the inventory the cost of the various transformers made could be secured. I have already stated why that is not the case. In question and answer 65 he proves that what I have stated about the inventory is correct.

He states when he is asked whether on those occasions when he had reason to refer to the inventory for the purpose stated, he found that the inventory gave the data he was looking for, and he states, "Yes, it was usually that I looked for some piece of apparatus or transformer that was on hand at the last inventory, and I wanted to price it the same as it was priced the previous time,"
666 showing that the actual value of that inventory had absolutely nothing to do with it, but the price that was given in the previous inventory was the one he would use in the next inventory, regardless of the actual value of that apparatus at that time.

And in question 66, and his answer thereto, he states that he would find the cost of that particular part of the apparatus, and he would find instead of the cost the cost estimate. The inventory prices were taken absolutely from the same sources from which our price for the sales department was taken, and the one was entirely subject to the same error as the other one was subject to.

Q. 328. Did these cost estimates to which you refer take into account waste material in the construction of transformers?

Mr. BAKEWELL: That is objected to. That is not a competent question to ask, any more than it is competent, as it has been decided, what a defendant loss on certain transformers that might be returned. The question is what the cost of certain itemized articles is.

Mr. FOWLER: I submit they have a right to show what these cost estimates included. In the construction of apparatus, or anything, for instance, a suit of clothes, there is a certain waste of material; and the waste of material is just as important a part of the cost, as the material that is used.

The MASTER: If the witness knows, he may answer that question. I do not see the materiality of it.

A. These cost estimates were based on everything running smoothly. If any waste occurred in the manufacture of the transformers, from the beginning of the winding to the finished coil, it is not included in these tables (indicating Complainant's Exhibits Blue Prints A and B). In other words, to illustrate this to your Honor, I wish to say that transformers manufactured in those days particularly, it was tedious work. A man might in five thousand turns have five turns wrong. That coil was all sealed up and all finished, and the wrong counts would practically destroy that coil and make it useless; and would destroy a complete primary coil of any one of those sizes. Furthermore, in placing the iron on the coil, possibly in the insulating test, a coil would break down. We had a rule that no broken down coil was ever fixed up. The greater part of the time the coil would be immediately destroyed. The iron might not be up to the requirements, and we would possibly attempt to get the iron within the requirements by reannealing it.

667 If it did not come within the requirements after being reannealed, we would have to destroy the iron. All those are irregular losses and could not possibly be taken account of in a cost estimate; and, therefore, were not included therein.

Q. 329. Mr. Johannessen further testified for the complainant in this case before the Master as follows:

"Question 41. If the voltage and frequency were given in this tabulated statement of transformers made and sold by the defendant between June 24th, 1896, and November 19th, 1901, with the other data given in this tabulated statement, and assuming the records of the Wagner Company to have been preserved, what have you to say as to whether or not you would be able to determine, if you had access to the complete records of the Wagner Company, the cost to that Company of the transformers given in this list?"

"Answer. It would be quite possible to get at the correct factory cost to within a very small per cent."

"Question 42. What do you mean by a very small per cent?

"Answer. Well, to within approximately 2 per cent."

Mr. BAKEWELL: I have not objected heretofore to this manner of putting a number of questions in one; but in this instance I shall object to it. If counsel wants to ask that specific question, it should be put by itself. I submit it is not proper if I object to it, for counsel to frame a question which embraces quotations from several questions and answers put to a witness. If he wants to direct the attention of the witness to some particular point, he should specify the particular point and then take up another question. It makes it much more difficult for me to cross-examine, and I do not think it is a proper method, if it is objected to.

Mr. FOWLER: It is all on the same line.

Mr. BAKEWELL: For instance, to illustrate what I mean, I respectfully submit the only way to ask that witness in regard to that statement, is to produce the records of the company, and see whether or not, based upon those records, it would then be possible to determine whether this present witness on the stand or Mr. Johannessen is correct.

Q. 329 (continued). What have you to say to that?

The MASTER: The witness may answer the question.

A. Mr. Johannessen makes a mis-statement for the reasons already enumerated in my former reply, namely, that he could give nothing but cost estimates. And there had been so many cases where even his cost estimates did not come within 25 per cent of what
668 we figured the cost of some particular job had been, that he is, I think, very presumptious to assume that he can get even a cost estimate to within two per cent.

Q. 30. Mr. Johannessen further testified in this case before the Master, as follows:

"Re-D. Q. 107. During the time covered by this report of Mr. Layman's from June 24, 1896, up to and including November 19th, 1901, what have you to say as to whether or not it was recognized at the factory of the Wagner Company that there was a distinct advantage in making transformers such as those embraced in that list and which embodied in their construction the invention the subject matter of claim 4 of the Westinghouse patent in suit, which invention, in accordance with the claim, consists in, "The combination, substantially as described, of an electric converter constructed with open spaces in its core, an enclosing case, and a non-conducting fluid or gas in said case adapted to circulate through said spaces and about the converter?"

"Answer. That fact was recognized. In designing a transformer it was, in general, the practice to allow a definite amount of space for the cooling of the core. In all the designs that I made of type D transformers, I allowed approximately one-eighth of an inch to every inch of iron mounted. In the type G line, the amount of

space was slightly reduced, owing mainly to the length of the core, which in that type was quite short. In providing these air spaces for the core, it was necessary to add material to the coils; that is, the coils had to be made longer. Besides, the spacing strips themselves were also an extra expense."

What have you to say, generally stated, as to the recognized advantages of transformers such as those given in the list by Mr. Layman, and which it is stated embodied in their construction the invention the subject matter of Claim 4 of the Westinghouse patent in suit.

A. The advantage is both in getting cooler operation of the coils adjacent to the core, and also to the core itself. And it also reduces the operating expenses.

As to the recognized advantage at that time in the Wagner factory of constructing transformers with spaces in the core, I know positively that before Mr. Johannessen took hold of the designing of the transformers line, we had air spaces. And they had been accustomed to use it in the earliest transformer, which I designed. And in designing the earlier transformer, I had before me the Westinghouse and the Stanley transformer. The Westinghouse transformer had no air spaces; the Stanley transformer had air spaces. The Stanley transformer at that time was considered
669 the best transformer in the market, and engineers in general were very partial to the construction of the Stanley transformer, I know positively that was my main reason for making our transformer with air spaces. We did not construct oil transformers at that time, nor did the Stanley Company.

Mr. BAKEWELL: What is this witness talking about? We are concerned here, specially, with oil cooled transformers.

Mr. FOWLER: Let him speak, and finish his answer.

Mr. BAKEWELL: I am here representing my client, and I am here to object to questions. This man might as well talk about how the moon is made up. I am not going to have the record lumbered up with matters which are utterly irrelevant. It is my privilege to stop him and make my objection. Let the Master decide whether I am right or not.

Mr. FOWLER: Let the witness answer the question. He has not made a very long answer.

Mr. BAKEWELL: He is not answering the question, and has not answered anything relevant or material to this case.

The MASTER: The witness may answer the question, confining himself as closely as possible to the question propounded.

A. (continued). When we began to manufacture a line of oil filled transformers we used absolutely the same coils we had used before for air transformers, and placed them in the oil. Therefore, it was a factory custom, and not a recognized advantage, using the spaces in an oil filled transformer.

This refers, of course, only to Type D; as the later types were designed, Mr. Johannessen kept in line with former designs, with former factory practice, and continued the air spaces in the laminae. The only recognized advantage was the air space to the core next to

e copper coils, and it was the subject of a great many conversa-ons between Mr. Johannessen and myself. Every effort was made keep that air space as large as possible in our designs.

Mr. BAKEWELL: I object to the entire answer, as absolutely in-mpetent, irrelevant and immaterial to any issue in this case, and ot in the slightest way calculated to contradict even the witness of e matters alluded to in the question.

At this point recess was taken until two o'clock.

After recess on Thursday, December 7th, the following proceed-gs were had:

Q. 331. In your last answer you referred to the effort to make the air space to the core next to the copper coil, as large as possible: will you please explain what air space you mean by "the air space to the core next to the copper coil?"

Mr. BAKEWELL: That is objected to as immaterial.
The MASTER: The witness may answer subject to the objection.

A. It is possibly misleading to refer to the air space at all in an oil lled transformer. I referred, in this case, to the space between the pper and the iron, as against the space between the iron. If you ill allow me to refer to the model, I can explain it much quicker.

The witness here refers to Wagner models heretofore introduced evidence.

I mean this space here (indicating) as compared to this space ndicating).

Cross-examination.

By Mr. PAUL BAKEWELL:

X Q. 332. Referring to the manufacture of those transformers, uring the period of time referred to by the witness Johannessen nd Foster, I understood you to state in your direct examination, hat you were able to ascertain at the end of a year's business, by the eneral business statement, what had been—to use your words, "Our ost": what business statement was that to which you referred?

A. I meant our regular trial balance, and such statements as were otten up for the inspection of our president and our board of di-ectors. And I had in mind the usual business statements, showing xpenditures and income.

X Q. 333. Would that statement show the actual cost of the trans-ormer business?

A. No sir, it would not. In referring there I did not mean to peak of the transformer business [along], but of our total business, ncluding transformers.

X Q. 334. What is your present business?

A. I am at the present time secretary of the Citizens' Industrial Association of St. Louis.

X Q. 335. You do not mean to be understood as stating, Mr.

Schwedtman, that during the period of time referred to by Mr. Johannessen, it was not the practice of the Wagner Company to add to the estimated manufacturing cost a certain percentage as a basis for fixing the actual cost, and that in addition to that percentage, which I have just referred to, it was not the practice of the Wagner Company to add another percentage in fixing the selling price, the purpose of the last percentage being to represent the profits?

671 A. It was our practice to get all we could get for our apparatus, regardless of the cost estimates.

X Q. 336. Will you please answer that last question.

Previous question read to the witness.

A. We attempted to add a percentage to our factory cost estimates, in fixing the selling price; but, as a matter of fact, the price at which we actually sold had no relation to what we attempted to serve as a basis to the selling price.

X Q. 337. It is distinctly stated at the foot of Complainant's Exhibit Blue Print B, "These costs are without percents added", isn't it?

A. (After examining Complainant's Exhibit Blue Print B) That is the wording on the blue print, yes sir. "These costs are without percents added."

X Q. 338. On Complainant's Exhibit Blue Print A, it is distinctly stated, is it not, "Added forty per cent to sum of material and labor".

A. (After examining Complainant's Exhibit Blue Print A) That is the exact wording.

X Q. 339. You don't mean to be understood as stating that Mr. Foster was not authorized to make prices to the sales organization, do you?

A. No sir.

X Q. 340. In other words, he was authorized to make prices?

A. Yes sir. His authorization, however, was limited. In other words, he was only allowed to quote prices which we knew were excellent prices; and he had no authority whatsoever to make any reduction in those prices.

X Q. 341. The Westinghouse Company, the complainant in this case, was a competitor of the Wagner Company in the manufacture and sale of transformers, was it not?

A. Yes sir.

X Q. 342. It take it, Mr. Schwedtman, that during the time referred to by you in your direct examination, and by Mr. Johannessen in his testimony, to which testimony you have referred, it was the purpose of the Wagner Company to make money out of its transformer business, wasn't it? In other words, it was not in business "for its health," to use a slang expression?

A. No sir. But it is well understood among the officers of the company that the transformer business in some sizes was carried on at a loss, in order to get the alternating current business, and to be able to sell the whole line of transformers.

X Q. 343. Do you mean to be understood as stating, not as a matter of opinion but as a matter of fact, that the transformers made and sold by the Wagner Electric & Manufacturing Company, covered by the accounting in this case, were all sold at a loss?

672 A. No sir, I do not mean to be so understood.

X Q. 344. How long were you in the employment of the Wagner Electric & Manufacturing Company?

A. I do not remember the date of my entering the service, but I was one of two who tried to work in that company as a partnership before it was incorporated as a business. Mr. Wagner and I started the Wagner Company as a partnership, and I was in the employ of the Wagner Company continuously.

X Q. 345. What is your best recollection as to when the Wagner Company organized, so as to give us some idea of the time you were actually in the employment of the Wagner Company?

A. It must have been somewhere about 1890, but I think nearer 1891. I have not those dates fixed.

X Q. 346. From your business experience do you consider that a profit of twenty five per cent is an unreasonable or unusual profit in the business of manufacturing and selling a particular article—for instance, an article such as these transformers we have been talking about?

A. Yes sir, it is an unusual profit to realize.

X Q. 347. You say it is?

A. I say it is an unusual profit to find at the end of the year you have really made. It is not unusual to figure 25 per cent.

X Q. 348. You consider a profit of twenty-five per cent in a manufacturing business an unusual profit?

A. Yes sir, on standard lines like these.

X Q. 349. Would you consider it an unusual profit on a patented article?

A. No sir.

X Q. 350. It was the practice of the Wagner Company, during the time referred to by Mr. Johannessen, to keep records such as these blue prints, of estimated manufacturer's cost of the manufacture of these transformers, wasn't it?

A. It was.

X Q. 351. What other data, if any, was kept by the Wagner Company during that period, by which it could be gathered or estimated what the cost of these transformers was?

A. I believe it would be a difficult matter to separate the cost of the transformers from other apparatus manufactured. We have attempted various methods, such for instance as keeping stock orders; but when we came across some terrible discrepancies, which in individual cases I traced right down and found to be abnormal, we discarded systems of that kind. Later on, I do not know on what date, we began a system of charging all material and all labor to the various lines. I mean, keeping a ledger account. But it was, I think, some time about, if not later than, the period outlined in the schedule.

673 X Q. 352. But during part of the time outlined in the schedule, and during the time covered by the testimony of Mr. Johannessen, you had no better system than this estimated manufacturing cost system?

A. We had no better system.

X Q. 353. You do not mean by anything you have said in your

testimony to impugn the veracity of either Mr. Johannessen or Mr. Foster, do you?

A. I do not. I believe both men are straightforward men, and I only question their judgment and their knowledge.

The MASTER:

Q. 354. I understood you to say that at the close of each year's business there was a trial balance made: would that show, in connection with the other statements of settlement of the year's business, what the profits of the entire business had been during the year?

A. It should show that, your Honor.

Q. 355. Is there anything by which those records would show what proportion of the profit for the year was derived from the transformer business?

A. I am afraid not, except in a very imperfect way.

Q. 356. In other words, the business of the concern, in showing the annual balances, was all lumped together, without separating the various kinds of articles that were made?

A. I would not say that exactly, that it was lumped together; but it was separated more in the direction of materials, and sales expenses, and labor; instead of separating it into the transformer department, or the motor department, or the switch-board department.

By Mr. BAKEWELL:

X Q. 357. In other words, that trial balance might show a profit at the end of the year, and that profit would be whatever profit had been made in the business, whether made on transformers, motors, or switch-boards?

A. It would show on the whole, yes. But it would not be at all reliable as separating one department from the other. I think you may find that in some of those statements an attempt in that direction was made. But it was so absolutely unsatisfactory, even to us who had it in hand, that we were not sure of our own statements in that regard.

X Q. 358. In other words, the profits at the end of the year would be the profits on the transformers, motors and switchboards, everything together?

A. Practically so.

X Q. 359. All commingled?

A. Yes sir.

Mr. FOWLER: Our case is substantially closed, but we will not close it formally now. We will do so in a few days.

674 At this point the further proceedings in this case were adjourned, subject to call by the Master.

ST. LOUIS, FRIDAY, *December 29th*, 1905.

Met pursuant to adjournment as above, and agreement of parties, on Friday, December 29th, 1905, at the office of Messrs. Fowler &

Bryson, in the Commonwealth Trust Building, in the City of St. Louis, Mo.

Present: Mr. H. H. Denison, Special Master; Mr. Paul H. Bakewell, in behalf of the Complainant; and Mr. Albert C. Fowler, in behalf of the Defendant.

And the following proceedings were had:

H. F. SELLINGER, a witness of lawful age, being duly produced, sworn and examined, on the part of the Defendant, testified as follows, to-wit:

Direct examination.

By Mr. ALBERT C. FOWLER:

Q. 360. Please state your name, age, residence and occupation?

A. H. F. Sellinger; forty-one; 5239 Lansdowne Avenue; general foreman for the Wagner Electric Manufacturing Co.

Q. 361. Where are you employed at the present time?

A. I am at the Wagner Electric Manufacturing Company.

Q. 362. How long have you been employed by the Wagner Electric Manufacturing Company?

A. About fifteen years.

Q. 363. What have been your duties there during your time of employment?

A. I had charge of the practical work in the transformer department.

Q. 364. Please explain a little more in detail what your duties are in this connection?

A. My duties consist in the building up of the transformers according to instructions from the engineering department.

Q. 365. Do you know Mr. S. E. Johannessen, who was formerly employed by the Wagner Company?

A. Yes sir.

Q. 366. What, if anything, did you have to do with him at the Wagner Company?

A. Mr. Johannessen and I practically ran the department—the transformer department. He would design them.

Q. 367. Mr. Johannessen testified in this case before the Master as follows:

"Question 10: During that period of time did your duties enable or require you to ascertain the cost to the Wagner Company
675 (I shall refer in my questions to the Wagner Company, for the sake of brevity) of transformers made and sold by the Wagner Company?"

"Answer. Yes sir; during the period that I was engineer of the company, it was my duty to get up the price or the cost of the transformers. These costs were very carefully made up in every detail. Every item connected with the manufacture and with the material contained in the transformer was included in these costs."

What have you to say to this statement of Mr. Johannessen?

A. In regard to costs I will say that Mr. Johannessen—that the costs were gotten up carelessly at that time—without system. For

this reason: in the first place, Mr. Johannessen did not know the price of labor on a certain transformer. He would very often design a transformer beforehand, and then have the iron cut in order to have it fit the transformer. Then again he would design coils which had to give a certain weight, and were far above that, far in excess of the weights. My superior at that time, Mr. Schwedtmann, often came to me to design transformers in place of Mr. Johannessen, because he stated to me at that time he could not get the figures correct from Mr. Johannessen, owing to his guess-work. There was no system whatever in connection with the estimates. His transformers were in such condition that you could not rely upon his figures at all. He would wind the coil, and if it would not be the very best iron we would have to go to work and un-wind the coil and do the work twice, and sometimes three times, over again. I might [remark] that, in connection with that, while I worked under Mr. Johannessen, in the engineer department, I would oftentimes design transformers under him; and the price, of course, has been given on a transformer, but sometimes they would find that they could not use the same insulation, or core, or the same case. Then they had to put in other goods, and that, of course, would upset the calculations.

Q. 368. You referred in your last answer to the price or cost of labor in manufacturing transformers. Who fixed the price of labor for manufacturing transformers?

A. I did, at all times.

Q. 369. What means had Mr. Johannessen of knowing the cost or the price of labor involved in the manufacture of transformers?

A. None at all. He could only guess at it.

676 Q. 370. In your answer to Question 367 you referred to "insulation". Will you please state a little more in detail what you mean and refer to by "insulation"?

A. Insulation is a material which is of different varieties. We have them of muslin, silk, etc. We require in the design or construction of transformers a certain amount of insulation. Now it is next to impossible for an engineer to properly calculate the amount of insulation required. Take in consideration this case particularly, in the construction of a transformer,—which has been the case in the design of Mr. Johannessen's transformers.

Q. 371. Please explain what this insulation is used on, and where it is used, etc.?

A. The insulation is used for the following purposes. In the first place, all the copper wire which we use has insulation, which consists of cotton insulation, which is wrapped around at the factory, on the winder. In addition to that, they use a certain amount of insulation, which depends again on the voltage of the transformer, the number of layers, and the number of turns.

Q. 372. About what proportion of the cost does the insulation of a transformer bear to the transformer as a whole?

A. Well, this again depends on the voltage of a transformer. But the average will probably reach from fifteen to thirty per cent. of the cost of construction.

Q. 373. Now, you say that you fixed the price of labor in manu-

facturing of transformers. Did Mr. Johannessen ever consult you about the cost of labor in the manufacturing of transformers, or did you ever communicate to him what was the price of labor which you fixed in manufacturing transformers?

A. No sir. But I made remarks to him repeatedly that I could not see how he possibly could meet our estimates if he went to work and put in so much additional labor. And material, you might add to that.

Q. 374. Please look at the blue prints which I now hand you, "Complainant's Exhibit Blue Print A," and "Complainant's Exhibit Blue Print B," and state whether you recognize them, and if so what are they?

A. (After examining blue prints.) I never saw those in the factory, Mr. Fowler.

Q. 375. Do you recognize them at all, and when, if ever, did you see them?

A. I never saw them, to my knowledge.

Q. 376. Did you ever see any estimates like these in the Wagner Company during the time of your employment there?

A. No. I never have.

677 Q 377. Have you at any time during the past year made any search for data or estimates of labor and material in the construction of transformers; and if so, at whose request, and what was the result?

Mr. BAKEWELL: I object to that, your Honor, please. This is utterly incompetent, and not relevant or material to any issue in this case. Your Honor will remember that we have had Mr. Layman, on the stand, and Mr. Layman, in connection with the proofs which are shown in this case, distinctly stated that they had no data, from which they could give us any data in regard to the actual cost of the manufacture of these transformers, and of the transformers involved in this inquiry and covered during the period of time covered by the inquiry. Now he is asking this witness generally as to whether or not he has made any search during the past year for any data in regard to the manufacture of transformers. What transformers, I would like to know! And your Honor has heard the testimony of Mr. Layman reiterated here, and by every witness, and they say that they have no data other than that contained in these blue prints, from which could be obtained what the transformers involved in this inquiry may have cost.

I respectfully submit that the question as put is objectionable: in the first place, because it does not show that it relates to any inquiry that is made on this accounting; and in the second place, that it may be an attempt to contradict the testimony of their own witness.

Mr. FOWLER: If your Honor please, the statement has been made by Mr. Layman that he had a search made for these estimates and could not find any. Now, I simply ask this witness if he has been requested during the past year to make any search for data or estimates on transformers, at whose request he made it, and what was the result.

Mr. BAKEWELL: I also object to it because it has not been shown that this man had charge of any records, and that he was the proper person to make the search. I don't remember that Mr. Layman testified that a search was made, but he simply testified that there was no record.

Mr. FOWLER: This gentleman was in charge of the transformer department.

Mr. BAKEWELL: It does not appear that he was in charge of a single record during the period of the inquiry. There is no proper foundation made for this question. It is absolutely incompetent, irrelevant and immaterial to any issue in this case.

678 The MASTER: I think the question is objectionable in so far that it does not specifically confine the attention of the witness to the period involved in this inquiry, between the specific dates. But otherwise, so far as the question goes, I think that it may be allowed to be answered. The witness might possibly show that Mr. Layman was mistaken, and he might corroborate Mr. Layman. The object of the question, of course, I cannot determine.

Mr. FOWLER: If your Honor will permit me, I will limit this question specifically to the period of these schedules, to transformers constructed in the period of June 24th, 1896, to November 19th, 1901. I wanted to make the question a little broader than that, but I am perfectly willing to make it so.

The MASTER: The witness may answer.

Q. 377. (Repeated to the witness.) Have you at any time during the past year made any search for data or estimates of labor and material in the construction of transformers; and if so, at whose request, and what was the result?

Mr. FOWLER:

Q. Now that is limited to transformers made between June, 1896, and November, 1901.

A. I have; by request of Mr. Layman; and also on account of comparison on my own account. But I have not been able to find any records whatever.

Q. 378. Who is in charge of the transformer department at the present time in the Wagner Company,—I mean in charge of the actual construction of transformers.

A. Mr. Howell has charge of the special transformer department; and I am in charge of the standard transformer department; at the same time, I am in charge of the practical construction.

Mr. BAKEWELL: I do not see that this has anything to do with the case, what the costs of transformers now are, or anything of that kind.

The MASTER: I don't see the materiality of it, but it may appear upon further examination.

A. (continued.) I might have stated it different, Mr. Fowler. I might have stated that Mr. Howell has charge of the designing of all special transformers, and I have charge of designing all standard

transformers; and at the same time I have charge of the practical construction of all transformers.

Q. 379. Mr. Johannessen, in Re-D. Q. 107 before the Master, in this case, testified as follows:

679 "Re-D. Q. 107. During the time covered by this report of Mr. Layman's, from June 24, 1896, up to and including November 19th, 1901, what have you to say as to whether or not it was recognized at the factory of the Wagner Company that there was a distinct advantage in making transformers such as those embraced in that list and which embodied in their construction the invention the subject-matter of Claim 4 of the Westinghouse patent in suit, which invention, in accordance with the claim, consists in, "The combination, substantially as described, of an electric converter constructed with open spaces in its core, an enclosing case, and a non-conducting fluid or gas in said case adapted to circulate through said spaces and about the converter?"

"A. That fact was recognized. In designing a transformer it was, in general, the practice to allow a definite amount of space for the cooling of the core. In all the designs that I made for the Type D transformers, I allowed approximately one-eighth of an inch to every inch of iron mounted. In the Type G line, the amount of space was slightly reduced, owing mainly to the length of the core, which in that type was quite short. In providing these air spaces for the core, it was necessary to add material to the coils; that is, the coils had to be made longer. Besides, the spacing strips themselves were also an extra expense."

What have you to say to the statement?

A. Why, as regards to strips I would say that from experience gained in the business, and repeated tests made, I find that the spacing strips in our transformers have not improved the transformer. In other words, have not kept the transformer cooler. For this reason: a transformer built vertically, containing a lot of strips in the iron, does not allow the oil to circulate. A transformer built horizontally allows the oil to flow right through the core, up and down—or up rather—and naturally cools the coil and iron.

Mr. Bakewell: I object to that answer, because it is absolutely incompetent. If it is attempted by the defendant now to deny the utility of the invention the subject matter of the patent, which confessedly they have used, to the extent of hundreds, even thousands, of these transformers, I respectfully submit that, under the decision, they are estopped from so doing. I respectfully submit that in the decision of the Court in this case, the Carbide suit, by which the defendants concede that they are bound in their answer, it appears: First, that the invention the subject matter of Claim Four of the Westinghouse patent in suit, in respect to this particular combination called for by Claim Four, is a most valuable invention, and that the court found that the defendant did use that invention.

680 In the answer in this case that is conceded and admitted by the defendant. The court by its decree in this case has found that they have infringed; and we are before the Master here

for the purpose of ascertaining the profits that the defendant has made on the infringement of the patent.

I respectfully submit that it does not lie in the mouth of the defendant, through this witness, or otherwise to attempt to contradict the findings of the Court in the Carbide case, or to attempt to deny the utility of the invention, which confessedly and by the decree of the Court in this case, they have used. It seems to me that nothing can be clearer than this, under the decision, and I respectfully submit that this testimony given by this witness is utterly incompetent.

Mr. FOWLER: If your Honor please, this question was not directed to this point at all. I wanted the witness to take this answer and read it over, as a whole, which he has not done, and he is testifying only about the last sentence of the answer, and about a matter which I did not in the question particularly inquire about, and did not expect him to testify to.

Mr. BAKEWELL: In that case I respectfully submit that counsel agrees with me that it has nothing to do with the case.

Your Honor will notice that from the testimony he has gotten from the mouth of the expert Kneifer and others, that the whole trend of the defendant testimony is in that direction, notwithstanding the principles of law which come in there and estop the defendant from taking that position. The Counsel now says that that answer of the witness is not responsive to his question. So I respectfully submit that it ought to be stricken out and not considered by the Master.

The WITNESS: I will add something more to that question, if I am permitted.

The MASTER: The discussion is regarding the answer as far as it has gone; and while I am not able to see how that answer can be, standing alone, responsive to any issue in the case, I am, perhaps, relieved of any embarrassment in the matter by the fact that the counsel both seem to agree that it is not responsive to the question. And in that view of it, I will sustain the objection to the answer as given, and if the counsel desires to have the question read again to the witness, in order that his answer may be made more complete, he is privileged to do so.

Mr. FOWLER: Will you please read over the question and
681 answer of Mr. Johannessen, to which I called your attention, and state what you have to say as to the statements made in Mr. Johannessen's answer to that question? Just read that question and the answer over.

A. I will say that the company has not recognized the fact that that was any gain in spacing the iron. If I am allowed to testify, I will state that Mr. Johannessen has never designed a transformer which should have strips, with the exception of the Carbide transformers. As a rule, the transformers designed by Mr. Johannessen were so short that we could hardly get enough iron on, and a great many transformers for that reason had no strips whatever. Even in the Carbide transformers, we were not able to put the number of strips into the iron as given by Mr. Johannessen. I will further

state that the cost of construction is immaterial in a transformer with or without strips. The placing of the spacing strips is only a very small fraction in the present construction.

Mr. BAKEWELL: I respectfully object to that answer, so far as it relates—if the witness means to say by that, or the counsel is trying to draw out from the witness by his question any testimony relating to transformers which do not have open spaces in the core, and therefore do not contain the [while] of the combination called for by Claim Four of the Westinghouse patent in suit, then I respectfully submit that clearly that testimony has nothing to do with the issues in this case. Certainly this witness will not be permitted to deny, in view of the record in this case, and in view of the testimony taken before the Master, that the defendant has used, and in the hundreds and thousands of transformers, the precise invention called for by Claim Four of the Westinghouse patent.

Therefore, I respectfully submit that the entire answer of this witness is absolutely foreign to any issue before the Master, and cannot throw any light upon the issue before the Master.

If it be attempted to use this testimony of the witness, as I apprehend it will be, in view of the line of testimony that the defendant has already elicited from this witness, or attempted to elicit, that the invention the subject matter of Claim Four of the Westinghouse patent in suit which the defendant has confessedly used to a very large extent during the period covered by the accounting, is not useful,—then I respectfully submit that testimony is absolutely improper, incompetent, irrelevant and immaterial to any issue that is before this court.

Mr. FOWLER: May it please your Honor, I submit that the answer now made by the witness is responsive to the testimony given by Mr. Johannessen in this answer. If the complainant did not consider this as relevant or material or competent, why did the complainant ask Mr. Johannessen this question and introduce
682 this testimony? Now this witness' testimony contradicts Mr. Johannessen about allowing a certain amount of space in all these transformers. It is a direct contradiction.

I have not heretofore said anything in reply to the remarks of the counsel of complainant on this question of usefulness; but his attitude seems to be that, inasmuch as the Court has found that this invention is a new and useful invention, that that means that it is highly useful, and very useful. But there are plenty of cases and authorities which go to prove and establish that without any question, this word "useful" means merely in the law that the device, that the invention, is not harmful, not against public policy or public morals, or something of that kind. That is all that it means when the Court finds that an invention is new and useful. It does not say that it is highly meritorious, or that it adds materially to the efficiency of the thing. It only means that it is new, and that it is not harmful. And here the counsel has talked all the way through of the great utility of the thing, as though the Court had pronounced it an invention of the utmost utility and indispensability.

Mr. BAKEWELL: Your Honor will notice from the answer of the

witness to which I took exception, that the witness undertakes to answer in regard to transformers that do not contain the invention of Claim Four; and in regard to transformers that do contain this invention, that there is absolutely no utility in them. Now the gentleman has been talking in the abstract and not in the concrete as applied to this case.

The gentleman who drew up the answer in this special suit, which is binding on the defendant in this case, has absolutely declared in paragraph 8, that the matters and things found in the decree in the said suit against the Union Carbide Company was res adjudicata against this defendant.

It appears from the record in this case, from the opinions of the Circuit Court and the Court of Appeals in the Carbide case, which are before this court, and it also appears from the admissions in the answer, and from the express findings of the Circuit Court and Court of Appeals in the Carbide suit, that the invention the subject matter of Claim Four is not only of value, but of very great value, in transformers. But, whether it be of great value or of small value, I respectfully submit that it does not lie in the mouth of this defendant to attempt to deny the utility of this invention.

And that is peculiarly true in this case, where the defendant is bound, and admits that he is bound, not only by the decree but by the findings of the court in the Carbide case. So we have an
683 exceptional case here: not only one where the general principles of law to which I have referred are applicable, but one where the defendant has gone out of its way to admit that it is bound by the decisions in the Carbide case, this defendant having conducted the defense of that suit against the Union Carbide Company.

The MASTER: The matter gets back to the very position that I have indicated as being held by the counsel on the opposite sides. The Court has held that the subject of Claim Four of the Westinghouse patent was a new and useful invention; it has found the defendant guilty of infringement; the defendant has admitted that it is bound by the decree in the Carbide case; and the matter comes to me from the Court for the assessment of damages.

Now on one side the counsel claim that the damages should be assessed upon the invention embraced in Claim Four as an entirety. On the other side they claim that the damages should only be assessed on that part of Claim Four relating to the spacing in the core between the coils and the core, as segregated from the rest of Claim Four.

Now, so far as the testimony is directed to holding that Claim Four is not a useful and a new invention, and consequently patented, and as the patent has been infringed, I think that the testimony will be incompetent so far as it may possibly tend—and I take it for granted the counsel is endeavoring to have this testimony so tend—to the mitigation of the damages; I think that the testimony may stand, presuming that the counsel will endeavor to make it clear to me in what way the testimony does tend to the mitigation of the damages. It is impossible for me, without the whole matter being elaborated, to determine as to whether this testimony will tend

to the mitigation of damages. If it does, it is material; if it does not, it will be disregarded. But I don't think that I would be justified in excluding [*in*] on that account.

Mr. BAKEWELL: Your Honor, I feel it necessary to make one statement here, because, perhaps, through an inadvertance, your Honor has not, as I understand it, stated the position of the complainant's counsel correctly. I am only claiming an accounting of profits on account of the infringement of the invention which is the subject matter of Claim Four. I am making no distinction between Claim Four and the other claims of the petition; but I am claiming that Claim Four, as it speaks for itself, and has been decided by the Court in the Carbide case in this city, is for an
684 entire thing—a transformer composed of certain parts, having certain parts and elements and combinations in it. I am simply taking that claim as it is, because the Court has decided over and over again that each claim of a patent is a patent itself. I simply find it necessary to state that, so that when your Honor comes to read the notes you will see that if I did not make this remark, and it stood on the record as your Honor has stated complainant's position, it might be——

The MASTER: I don't think that I misunderstood the position of the counsel. I may have used the word "patent" when I did not refer to the claims of the patent.

By Mr. FOWLER:

Q. 380. In this answer of Mr. Johannessen to which I have called your attention, he says "In designing a transformer it was, in general, the practice to allow a definite amount of space for the cooling of the core."

The MASTER: Mr. Fowler, is that the same question?
Mr. FOWLER: The same question.

Q. 380 (continued). Please state if it was the practice to allow a definite amount of space for the cooling of the core; and you may state, if you please, what was your practice at the time referred to in this question, of constructing transformers, with reference to spaces in the core?

A. On our very first transformer we had constructed we found that the iron core was not large enough to tighten the transformer between the grooves and the case. In consequence of which, we tightened up the core, which naturally enlarged it; and by this operation we were enabled *it* [*to*] place the core tight in the case, to keep it from moving about. At no time has Mr. Johannessen given me instructions to place any strips between the iron, with the exception, as stated before, in the Carbide case. I will further state that those spacing strips were my own invention. I simply used them, as I stated before, to tighten the iron.

Mr. BAKEWELL: If it should be attempted to use the testimony of this witness, and his last answer, where he refers to spacing strips as being his invention, for the purpose of claiming that the idea or the invention the subject matter of Claim Four of the Westinghouse

patent in suit, which involves the condition of having open spaces in the core, together with the other elements named in that claim, was not the invention of Mr. Westinghouse, but the invention of this witness, I respectfully submit that that testimony must be stricken out from this record.

685 Mr. FOWLER: There will be no such contention.

Mr. FOWLER:

Q. 381. You have spoken in your last answer about tightening the iron of the core. Will you please state how this was done?

A. In placing the iron in the transformer it is not possible to put the iron on tight. That is, it is not possible to put the iron in entirely tight. And we, therefore, thought it necessary, in order to enable us to hold the transformer firmly in the case to enlarge the core, which operation was performed through placing strips into the core.

Q. 382. In the answer referred to of Mr. Johannessen, he says that it was your practice to allow a definite amount of space for the cooling of the core. By that I understand that for so many inches of iron in the core it was your practice to allow so many inches of space. Will you please state what your practice was in that particular, and whether you did allow a definite amount of space in the core, whether the space in the core was uniform, or whether it varied?

Mr. BAKEWELL: I object to this question, your Honor. The witness has been asked in regard to this matter two or three times. He has had the question and the answer of Mr. Johannessen before him. He has had full opportunity of answering the questions, and he has answered them. Now this question is not only leading, but, as your Honor must have noticed, the counsel quotes from a part of the answer of Mr. Johannessen and then proceeds to say what he understands that answer to mean, and then questions the witness by really a leading question as to what the witness now has to say as to defendant's counsel's understanding of Mr. Johannessen's answer.

I respectfully submit that that question is thoroughly incompetent.

Mr. FOWLER: I submit, your Honor, that the question is merely directed to bring out the fact, whatever it was, and I put it to the witness so that he will understand the point that I desire to bring out. If they did allow a definite amount of space in the core, let the witness state it. If the space was uniform, or if it was not uniform. I think we are entitled to know to what extent the subject matter of Claim Four was used by the defendant.

The MASTER: I think the counsel is entitled to his answer to this question, as being directed to the contradiction of Mr. Johannessen's testimony.

The question was here read to the witness.

686 A. Mr. Johannessen in none of his designs has any instructions whatever as regards to spacing strips. To illustrate this fact I will say that in many cases we had no space—we could not put spacing strips into the core, because the iron losses were so high

that we had to crowd on all the iron we possibly could. The spacing strips were merely a side issue in our construction at that time, and we only placed them in transformers where we could.

Mr. FOWLER: You have not quite answered the question.

A. The spaces were entirely indefinite. On some transformers we might have put in one space, and on another of the same size probably two. It depended entirely, as I said before, on conditions, whether the iron would allow it or not.

Q. 383. Won't you please explain what these conditions are which allow spaces, and what the conditions are that will not allow spaces or will not allow the spaces to be as large? Please explain this so that it can be understood.

A. Well, we, for instance, have a transformer mounted. That is, we have the core placed around the coil. And we find that either the iron loss *it* too high, and in order to meet certain guarantees we have to put more iron on, crowd more iron on, all the iron we can possibly get on; which naturally tightens the core to such an extent that it is impossible to place any strips between the iron. In those cases we simply let the core go without strips. In other cases again we find that the iron has been put on it by probably a new man—not capable of putting the full amount of iron on. In this case we put on strips probably one or two, probably more.

Q. 384. And as I understand it, the spaces in the core of the same size transformer might and did vary in these transformers? Is that correct?

A. Yes, sir.

Q. 385. When did the Wagner Company discontinue using open spaces in the core on oil filled transformers.

Mr. BAKEWELL: That is immaterial, your Honor, please. We are concerned here with the number of transformers that the Wagner Company made during the period of this accounting. We have that, or are supposed to have it. Mr. Layman swears that we had it.

Now, that being true, and we being concerned only in the profits on these transformers, it is utterly immaterial, it seems to me, when they stopped manufacturing the infringing transformers.

The MASTER: I am not clear about that, Mr. Bakewell. The matter is upon an assessment of damages for infringement. If
687 it can be made to appear by the defendant that during any period of the time including in the finding of the Court that the Claim was not being infringed, that is to say, if they had ceased infringing before the expiration of the period for which we are making examination,—I am not sure but what, from the standard of the defendant, it might be relevant as mitigating the damages which complainant is entitled to recover.

At any rate, I will allow the question to be answered, assuming that the counsel will make clear as to how the testimony is to be used in the mitigation of damages, for of course that is the only object of defence, the mitigation of damages, and the only subject of the inquiry is the assessment.

The question was here read to the witness.

A. I think about four years ago.

Q. 386. How does the cost of manufacturing oil-filled transformers with open spaces in the core compare with the cost of manufacturing the same transformer without open spaces in the core.

Mr. BAKEWELL: If your Honor please, I respectfully submit that it is not competent for this witness to go into that matter. This question is also not confined to the cost of manufacturing these transformers during the time covered by this accounting, but it is a general question. If the witness were able to answer now what the cost of manufacturing the invention of Claim Four is as compared with the cost of manufacturing a transformer which did not embody the invention of Claim Four at the present time that would not help the Court on the rightful settlement in regard to this inquiry. We are concerned now with the cost of manufacturing those transformers during the time covered by that accounting. And in that, I understand from the testimony taken by the defendant that there is no data from which they can ascertain what that cost was.

Mr. FOWLER: I will limit the question to that period of time.

The MASTER: Well, please do limit it.

Mr. FOWLER: I will limit it to the period from June 24th, 1896, to November 19th, 1901.

Mr. BAKEWELL: Well, my objection still exists, because it has not been shown that the witness is competent to testify.

The MASTER: I was just going to say that. If the witness is capable [os] stating what the cost of manufacture was, he is entitled to do it.

688 Mr. FOWLER:

Q. 387. I will make the question, Are you able to state how the cost of manufacture of oil filled transformers with open spaces in the core, at the period inquired about, namely June 24th, 1896, to November 19th, 1901, compared with the cost of manufacturing the same transformers without open spaces in the core?

A. Yes, sir.

Q. 388. Please state the facts.

A. In the first place, I allowed a man the same price for mounting a coil, whether it had strips or not. And the additional expense of the spacing strips is very small, not being above ten cents on a large size transformer. Or on a ten kilowat- it would be less than on a smaller size.

Q. 389. Are you able to state whether oil filled transformers with open spaces in the core, during the period inquired about in the last question, Number 388, sold for a greater or less price than the same transformers without open spaces in the core?

Mr. BAKEWELL: I respectfully submit that that question is objectionable for two reasons. In the first place it does not appear from the testimony of this witness that he is competent to testify as to the selling price of the transformers, that he had anything to do with the sale of transformers; and in the second place it does not appear from the question that the witness is called upon to contemplate the

cost of the transformer embodying the entire invention the subject matter of Claim Four, the subject matter of this suit. Non constat, from the form of this question it may mean any kind of transformer.

Mr. FOWLER: It says "Oil filled", Mr. Bakewell.

Mr. BAKEWELL: I don't care what it says, you have not directed the attention of the witness to the particular kind of transformer embodied in Claim Four, and this is the only one we are interested in.

The MASTER: Please read the question.

The question is here read to the Master.

The MASTER: It is proper that he should state whether he is able to state it or not. That is the only question there. Requiring yes or no—whether he is able to state. It is a question of competency for the witness to testify upon that point.

Mr. FOWLER:

Q. 390. What do you say as to whether you are able?

689 A. I am, for this reason. Because our orders for transformers did not specify the spacing strips, and we therefore filled the orders regardless of whether they had strips or not.

Mr. BAKEWELL: I object to that. It is not a competent answer.

The MASTER: That is not an answer to the question.

Mr. FOWLER: The question is are you able to state whether the transformers sold for more than others or for less?

A. Well, I am.

Q. 391. How are you able to state about the selling price of these transformers? What do you know about that?

A. I will repeat the same statement that I made before.

Mr. BAKEWELL: Your Honor, that is the foundation of his knowledge, and——

The MASTER: The question is, how are you able to state?

A. Well, I did not know the price at which it was sold at the time. But I know that the orders were filled as they were finished.

Q. 392. Do you know what transformers made at the Wagner Company sold for?

The MASTER: I understood him to say right there that he did not know?

The answer was here read.

Mr. FOWLER: Then I will drop that.

Q. 393. Are you able to state how oil filled transformers with open spaces in the core compared in point of operation and efficiency with the same transformer without open spaces in the core? A. Yes sir.

Q. 394. Please state it.

Mr. BAKEWELL: I object to that question. That is not a competent element in the question to ask.

The MASTER: I doubt very much whether the question is com-

petent, but the witness may answer it, in order that the counsel may have his question on record.

A. There is nothing gained by spacing our transformers. The transformer, therefore, is of equal efficiency, with or without strips. Of uniform efficiency.

Mr. BAKEWELL: Complainant's counsel again emphasizes the objection that he has made to this line of testimony taken by
690 the defendant. Your Honor will remember, will know by examining the authorities, that the question of utility or non-utility of the invention is an issue that may be raised by the pleadings and an issue that must be specially pleaded. The utility of this invention is not only admitted by the answer in this case, but the utility of the invention, and its great utility, is admitted by the answer in this case, in view of the fact that the Court so found, the Court of Appeals, and the Circuit Court, and they have admitted that they are bound by that.

Now, here they come by their witness attempting to show, after all, disguised as it may be—by witnesses who have been seen and talked to before they are put on the stand—trying to show that there is no utility whatever in the invention the subject matter of this patent. Either their witnesses testify to that, or they testify to nothing.

Now there is no such issue can be raised, I respectfully submit, in view of the pleading in this case, at this stage or any other stage of this suit. And I say that, in invoking the additional ruling, in which the authorities are all in entire accord, that it does not lie in the mouth of the defendant to deny the utility of the invention which it has used, and here they are trying to deny absolutely any utility in the invention which they have confessedly used to the manufacture of thousands of transformers.

The MASTER: Well, the Master would say that it is in view of the pleadings and the decree of the Court that the Master has expressed his doubts as to the competency of this testimony. But, as there is but one matter of defense, and that is the mitigation of damages, I will allow this testimony to be introduced, for the purpose of giving the counsel for the defendant the opportunity of using it, if it may be so used, in mitigation of damages.

And, as I have stated before, it is not clear to me how that will be done. That, of course, the counsel will undertake to show. I do not assume to control the counsel as to the manner in which he shall introduce his testimony, or the quality of that which he shall introduce.

Mr. FOWLER: That is all.

Cross-examination.

By Mr. BAKEWELL:

X Q. 395. How old are you?

A. I will be forty-one my next birthday.

X Q. 396. When did you first enter the employment of the

Wagner Company? A. About 1891.

691 X Q. 397. What was your position with the Wagner Company when you first went with them?

A. I started as foreman.

X Q. 398. You started as foreman?

A. Yes.

X Q. 399. Of what?

A. Of the transformer and motor department.

X Q. 400. In 1891?

A. Yes, approximately—the latter part of 1891.

X Q. 401. Was Mr. Johannessen in the employment of the company at that time?

A. No sir.

X Q. 402. When did you first know Mr. Johannessen

A. I think he came there about three years later, if I am not mistaken. I don't exactly remember, but about three years later. 1894 or somewhere along there.

X Q. 403. Were you employed under Mr. Johannessen?

A. No sir.

X Q. 404. What was your relation?

A. Mr. Johannessen was in the transformer department, and I had charge of the department of winding the coils and the practical work. At that time.

X Q. 405. Did I understand you correctly to state that you fixed the price of labor involved in the manufacture of transformers?

A. Yes sir.

X Q. 406. You fixed the labor during all the time that you were foreman?

A. Yes sir.

X Q. 407. And while Mr. Johannessen was there?

A. Yes sir, and I do it now.

X Q. 408. How did you fix the price of labor?

A. I fixed it by experience. In the first place I got a new coil to wind and gave a man the job to see how long it took him to wind the coil. And by that I fix- the price.

X Q. 409. You fixed the price on each transformer?

A. Yes sir.

X Q. 410. You fixed the price of labor on each transformer?

A. Yes sir.

X Q. 411. Did you keep a record of the price of labor on each transformer during the time you were with the Wagner Company?

A. Yes sir.

X Q. 412. And during the time that Mr. Johannessen was there?

A. Yes sir.

X Q. 402. You kept a record so that you could tell the exact amount of labor spent on each transformer?

A. Yes sir. That is, I had the price fixed, you know, for the set of operations. Not how much was expended on each one. I did not attempt to keep track of each transformer, but I had a price fixed for each operation, just as I do now.

692 X Q. 414. I understood you to say awhile ago that you kept tab on the price of the labor that went into each transformer. Did you?

A. Yes sir, I have, certainly.

X Q. 415. And you did that while Mr. Johannessen was there?

A. Yes sir. I will state, if the Court allows, I simply include standard transformers, not special transformers. Standard transformers only.

Mr. BAKEWELL: That is all I have to ask you.

Redirect examination.

By Mr. FOWLER:

Re-D. Q. 416. Please explain how you fixed the price or cost of labor, and what, if any record, was kept of the same.

Mr. BAKEWELL: I object to that, your Honor please. He had an opportunity to go into that, and did go into it on direct. My cross-examination was limited absolutely to what was referred to in direct examination. Now he speaks of what the records will show——

Mr. FOWLER: I did not ask what the records show.

Mr. BAKEWELL: I submit that if the record is read your Honor will see. They have had ample opportunity to produce the records. I ask that the question be read.

The question was here read.

Mr. FOWLER: I was not asking what any record shows. It is not clear to my mind from the witness' last answers what was done there.

The MASTER: The witness may answer the question. I doubt whether it is material.

The question was here read to the witness.

A. The prices were fixed in all cases by the time required to wind the coil. To perform that operation. And I have kept a record of those operations in standard transformers, in order to be able to check the men's time.

At this point further proceedings in this case were adjourned subject to call by the Master.

* * * * * * *

(Here follows the tabulation of orders for transformers, prices, etc., prepared from the records of the defendant, which tabulation is omitted pursuant to the stipulation of the parties set out at page 1 of this printed record.)

693 And afterwards, to-wit: on the 28th day of August A. D. 1907 there were filed in said cause certain Exceptions of said Defendant to the report of said Special Master, which said Exceptions are in words and figures as follows, to-wit:

(*Exceptions to Report of Master.*)

United States Circuit Court, Eastern District of Missouri, Eastern Division.

No. 4457. In Equity

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, Complainant,
vs.
WAGNER ELECTRIC MANUFACTURING COMPANY, Defendant.

Exceptions to Master's Report and Accounting.

Now comes the defendant in the above entitled cause, this 28th day of August, 1907, and excepts to the Master's report filed in this cause on July 29, 1907, and the accounting herein, because:

I.

The Master erred in awarding to the complainant all the profit which he found the defendant made on the sale of said infringing transformers during the period covered by the schedules filed herein of the sale of defendant's transformers;

(*a*) For the reason that the evidence establishes that the invention of Claim Four of the patent in suit is not and was not of controlling and vital importance in such transformers, and that such invention contributed but little to the sale and operation of such transformers and the profit thereon.

(*b*) For the reason that the complainant has not shown what was the profit made by defendant on its transformers due to the patented invention of Claim Four, as distinguished and segregated from the other features contained in said transformers.

(*c*) For the reason that defendant's said transformers infringed not only Claim Four of the patent in suit but the other claims of said patent, and complainant obtained a decree on Claim Four only.

(*d*) For the reason that it appears on the face of the Westinghouse patent sued on herein, lines 5 to 8, that the inventor, George Westinghouse, had "invented certain new and useful improvements in electrical converters" set forth in the specification of the patent in suit and of which Claim Four of said patent in suit was but one of said improvements; and it further appears on the face of
694 said patent, lines 51 to 56, that the transformer of the said Westinghouse patent was but a mere improvement on the induction coil or transformer of Albert Schmidt.

(*e*) For the reason that the evidence on this accounting shows that suit was brought by this complainant against a user of this defendant's transformers, to-wit, against the Montgomery Electric Light & Power Company of Canajoharie, New York, for infringing another transformer patent owned by this complainant, and that

the Circuit Court of the Northern District of New York held said transformers to be an infringement of said other patent owned by this complainant and ordered an injunction and accounting thereunder, which decree was affirmed by the Court of Appeals for the Second Circuit, a copy of the opinion of the Court of Appeals in said case having been furnished the Master in this case after the taking of evidence herein and before the Master rendered his report; and it furthermore appearing from the evidence herein that every transformer involved in this accounting is also covered by said other patent owned by this complainant.

II.

The master erred in allowing the complainant anything more than a nominal recovery of profits.

III.

The Master erred in holding at page 12 of his report: "So far as the utilizing of electric energy by means of the transformer is concerned, there was, during the entire period embraced in this inquiry, no other process or method known in electrical mechanics for increasing the capacity of transformers, excepting the Westinghouse patent known as Claim Four."

IV.

The Master erred in holding at page 19 of his said report: "It seems to me entirely immaterial for this inquiry whether the infringing transformers had or had not spaces between the coils and between the coils and the core."

V.

The Master erred in holding at page 19 of said report: "If the defendant has so used its infringing transformers by setting them up with the spaces in the core horizontal, instead of vertical, and for that reason, (to use the language of defendant's counsel on page 285 of the record of testimony,) 'If it carries out very im-
695 perfectly, and to a very minor extent, the purposes of the patent in suit' I am unable to see how that fact can be shown to affect the question of profits.

VI.

The Master erred in confounding at pages 19, 20, 21, 22, 25 and 26 of said report, the question of the infringement and validity of Claim Four of the patent in suit, with that of mitigation of profits.

VII.

The Master erred in holding at page 22 of his said report: "There is nothing in the Carbide case by which the defendant is admittedly bound, nor in the admissions of its answer which conclude it, nor in the evidence which tends to show that the infringing transform-

ers involved other claims of the patent," for the reason that it appears that this Court (Adams, Judge, 129 Fed. Rep. 605), in referring to the Carbide case held, "Before final submission of that case complainant dismissed as to claims 1, 2, 3, and 5, submitting claim 4 only to the final judgment of the Court."

VIII.

The Master erred in ruling at page 27 of his said report: "That the entire commercial value of the infringing transformers so manufactured and sold by the defendant, at and during the time concerned in this accounting, was due to the combination described in Claim Four of the Westinghouse patent."

IX.

The Master erred in finding at page 28 of his said report: "That the profits of the defendant from the manufacture of the infringing transformers, as nearly as it can be [reach-] 'through estimates, comparisons and apportionments,' is approximately 25% on the net amount of the sales of the infringing transformers."

X.

The Master erred in holding at page 32 of his said report, that no comparison can be drawn to affect the question of profits in this accounting, between the transformer of Claim Four of the patent in suit, and defendant's non-infringing transformer, referred to in this Court's decision, said non-infringing transformer having open spaces between the coils and between the coils and core for the circulation of oil but having no open spaces in the core.

XI.

The Master erred in holding at page 34 of his said report: "I am satisfied that the testimony of Professors Nipher, Gray
696 and Langsdorf, and Mr. George E. Wells, introduced on behalf of the defendant, is wholly irrelevant to the matter of this accounting."

XII.

The Master erred in holding at page 34 of his said report: "So also, neither the Thomson patent No. 516,850 referred to at page 196 of defendant's testimony, Prof. Nipher on the stand; nor the Moody patent No. 539,876, referred to by the same witness at page 197, are competent, in my opinion as bearing on the question of profits in this hearing."

XIII.

The Master erred, as stated by him on page 37 of his report, in adopting the method of the Circuit Court case of Force vs. Sawyer-Boss Mfg. Co., 131 Fed. Rep. 884, in ascertaining the profits in this case; for the reason that the said case was reversed by the Court of Appeals of the Second Circuit (143 Fed. Rep. 894), of which fact

the Master was advised by citation of said Court of Appeals decision in defendant's brief, showing that said Court of Appeals allowed the complainant in said case but a nominal recovery of profits.

XIV.

The master erred at pages 41 and 42 of his said report, in not allowing and crediting the defendant with $90,000.00 in this accounting for loss for mistakes in the manufacture of infringing transformers during the period covered by said accounting.

XV.

The Master erred in holding at page 46 of his said report: "I am convinced that the true interpretation of the testimony is that the 25% profit is to be calculated upon the flat labor and material account alone."

XVI.

The Master erred in finding that the factory cost of the said infringing transformers, as given at page 47 of his said report, was 40% of the cost of flat labor and material and that the profit was 25% of the cost of flat labor and material.

XVII.

The Master erred in including in this accounting at pages 48 and 49 of his said report, transformers made by this defendant and sold to the Union Carbide Company of Niagara Falls, New York, which sale amounted to $15,460.00;

(*a*) For the reason that complainant waived any claim as to such transformers at page 4 of the supplement to its brief and
697 expressly stated there: "Furthermore, we are perfectly filling to waive any claim for profits made by the defendant in the sale of the infringing transformers to the Union Carbide Company (a separate account of which is given at pages 183 and 183*a* of the schedule of infringing transformers furnished by Mr. Layman), as stated in our main brief on this final hearing before the Master."

(*b*) For the reason that it appears from page 568 of the printed record in said Carbide case, whirh said record was offered in evidence in this case and constitutes defendant's exhibit No. 1 herein, that by the decree in said Carbide case it was ordered and adjudged, "that the complainant recover out of the said defendant the gains and profits by it made and the damages sustained by the complainant by reason of such infringement" and said cause, by said decree was referred to the Master therein, "to ascertain the amount of such gains and profits and the damages sustained by said complainant by reason of such infringement."

(*c*) For the reason that the Carbide transformers, as the record shows, were modified by removing the open spaces in the core after the Court of Appeals' decision in the Second Circuit in said case,

thus eliminating therefrom the combination of Claim Four of the patent in suit.

XVIII.

The Master erred in recommending that judgment be entered herein in favor of the complainant for $132,433.35 because such finding is contrary to the law and evidence and such finding is error:

(*a*) For the reason, among others given herein, that the highest demand and claim made by the complainant in this cause was $106,406.92.

(*b*) For the reason that complainant in its brief before the Master, stated that complainant would be satisfied with $75,093.62, which amount complainant stated would give the defendant credit for all losses in its business during the period covered by the six years of infringement herein; and at the close of complainant's proofs in chief on accounting before the Master, complainant submitted a written statement referring to this same amount of $75,093.62, at page 5 thereof, stating, "This second rule is eminently fair to the defendant, because it deals only with the profits actually made by it deducting not only the cost of manufacture, general expenses, etc., but also the loss of the two years 1897 and 1900 which Mr. Layman states on page 64, was suffered in the business."

698 "However, complainant is satisfied to claim, and does here claim, if required to make any claim at this stage, the smaller amount as given by the second rule pointed out specifically by reference to Q.'s and answers, 54 and 55 by Mr. Johannesen's testimony, pp. 23, 24 and 25 thereof, which amounts to $75,093.62. This amount of $75,093.62 we claim as profits made by the defendant and attributable to the infringement by the defendant of Claim Four of the Westinghouse patent in suit."

(*c*) For the reason that the complainant suggested in its brief that the complainant recover of the defendant but $53,203.46, said sum being one-half of the $106,406.92.

XIX.

The Master erred in not sustaining defendant's demurrer to complainant's evidence at the close of complainant's case in chief.

A. C. FOWLER,
Counsel for Defendant.

St. Louis, Mo., August 28, 1907.

And afterwards, to-wit: on the 24th day of December, A. D. 1907, the following proceedings were had and appear of record in said cause as follows, to-wit:

(*Order upon Exceptions to Report of Master.*)

In the Circuit Court of the United States for the Eastern Division of the Eastern Judicial District of Missouri.

#4457.

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, Complainant,
vs.
WAGNER ELECTRIC MANUFACTURING COMPANY, Defendant.

This cause having heretofore come on to be heard upon the exceptions filed by said defendant to the report of Henry H. Denison, Esq., to whom as Special Master this cause had been referred for the purpose of stating an account of the damages and profits derived by said defendant from the unlawful infringement heretofore decreed herein, and said exceptions having been duly submitted to the Court upon the arguments and briefs of counsel, the Court now being fully advised in the premises doth Order that said report be disapproved and said exceptions sustained in so far as said exceptions are directed to the findings of said Master as to the amount of profits derived by said defendant from the sale of the infringing electrical transformers and to the recommendation of said Master for the entry of a judgment for the amount of profits so found, for the reasons set forth in the opinion of Court this day filed, and in lieu
699 thereof the Court doth now enter a finding upon said accounting for nominal damages in the sum of One Dollar; it is therefore

Considered, Adjudged and Decreed that the decree heretofore entered on February 16th 1904 including the injunction awarded thereby be and the same are hereby confirmed and made final; and that said complainant do have and recover of said defendant the sum of One Dollar so found as aforesaid, and also its costs and charges herein expended upon said accounting, for all of which execution may issue as at law.

DAVID P. DYER, *Judge.*

December 24th 1907.

And afterwards, to-wit: on the 5th day of March A. D. 1908, the following further proceedings were had and appear of record in said cause, as follows, to-wit:

(*Final Decree.*)

United States Circuit Court, Eastern District of Missouri, Eastern Division.

No. 4457. In Equity.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY
vs.
WAGNER ELECTRIC MANUFACTURING COMPANY.

Final Decree.

This cause having been commenced by the filing of a bill of complaint, and the defendant having duly answered and replication having been filed thereto, and the cause having come on upon the pleadings and proofs and the arguments of counsel for final hearing, and this Court having on the 16th day of February, 1904, entered an interlocutory decree in the following terms, to-wit:

"It is Ordered, Adjudged and Decreed as follows:

"That letters patent of the United States issued to George Westinghouse, Jr., for Electrical Converter, dated July 12, 1887, and numbered 366,362, and duly assigned to the complainant, Westinghouse Electric & Manufacturing Company, are good and valid in law, particularly as to the fourth claim thereof, and that complainant, Westinghouse Electric & Manufacturing Company, is the owner of said letters patent and all rights thereunder.

"That George Westinghouse, Jr., was the first, true and original inventor of the inventions and improvements described and claimed in claim 4 of said letters patent.

700 "That the defendant herein, Wagner Electric Manufacuring Company, has infringed the fourth claim of said letters patent, and upon the exclusive rights of the complainant under the same, by making, using and selling electrical converters or transformers embodying in their construction and principle of operation the combination, substantially as described in said Westinghouse patent of an electric converter or transformer constructed with open spaces in its core, enclosing case, and a non-conducting fluid in said case adapted to circulate through said spaces and about the converter or transformer.

"That complainant do recover of the defendant the profits, gains and advantages which the said defendant has derived, received or made by reason of said infringement by said defendant of claim 4 of the said Westinghouse patent No. 366,362, and that the complainant do recover of the said defendant any and all damages which the complainant has sustained by reason of said infringement by said defendant in the manufacture, use or sale of electrical transformers or converters found to be in infringement of claim 4 of said Westinghouse patent No. 366,362 as hereinbefore specified, or any electrical converters or transformers which embody in their construction and principle of operation the combination, substantially as described

in said Westinghouse patent, of an electric converter or transformer constructed with open spaces in its core, an enclosing case, and non-conducting fluid or gas in said case adapted to circulate through the spaces and about the converter:

"And this cause is hereby referred to Henry H. Denison, Esq., as Special Master, to take and state an account of said gains, profits and advantages, to assess such damages, and to report thereon with all convenient speed; and that the defendant herein, said Wagner Electric Manufacturing Company, its directors, officers, attorneys, clerks, servants and workmen, are hereby directed to attend before said Master from time to time as required and to produce before him such books, papers, vouchers, and documents and to submit to such oral examination as the Master may require.

"That a perpetual injunction issue out of and under the seal of this Court, directed to said defendant, Wagner Electric Manufacturing Company, its officers, directors, agents, attorneys, clerks, servants, and workmen, enjoining and restraining them and each of them, from, directly or indirectly, making, or causing to be made, using, or causing to be used, or vending to others to be used, in any manner, any electrical converters or transformers containing, embodying or employing the said invention or improvements
701 claimed by the fourth claim thereof, or from infringing or violating the said letters patent No. 366,362, as to the fourth claim thereof, in any manner whatsoever.

"And the Court having heard counsel for complainant and counsel for defendant herein, after due consideration.

"It Is Further Ordered, Adjudged and Decreed

"That the electrical converter or transformer referred to in the proofs in this case and illustrated in the printed pamphlet entitled "Wagner Electric M'f'g Co., St. Louis, Mo., U. S. A., Catalogue No. 102, Bulletin 59, 1903," one of the complainant's printed exhibits in this case; to-wit: a converter or transformer having open spaces between the coils and between the coils and the core for the circulation of oil and known as Wagner, Type M transformer, does not infringe claim 4 of said Westinghouse Patent No. 366,362, and that as to this last-named electrical converter or transformer the perpetual injunction herein-before referred to does not apply.

"And that neither party recover any costs in this action up to and including the entry of this interlocutory decree; but that in respect to the costs in this action up to and including the entry of this interlocutory decree, each party pay its own costs.

(Signed) ELMER B. ADAMS, *Judge*."

And the Master, Henry H. Denison, Esq., having taken and stated an account under said interlocutory decree, and having recommended to this Court, by his report filed heretofore, to-wit, on the 29th day of July, 1907, that judgment be entered herein in favor of the complainant and against the defendant for the sum of One Hundred and Thirty-two Thousand Four Hundred and Thirty-three Dollars, and Thirty-five cents ($132,433.35), being the amount of the gains, profits and advantages derived or received by the defendant by reason of its said infringement of claim 4 of said letters patent.

And the defendant having filed exceptions to said report, and the same having been duly heard and passed upon by the Honorable David P. Dyer, sitting as the Judge of this Court, and after consideration thereof the said Court having entered an order in the following terms, to-wit:

"This cause having heretofore come on to be heard upon the exceptions filed by said defendant to the report of Henry H. Denison, Esq., to whom as Special Master, this cause had been referred for the purpose of stating an account of the damages and profits derived by said defendant from the unlawful infringement heretofore decreed herein, and said exceptions having been duly submitted to
702 the Court upon the arguments and briefs of counsel, and the Court now being fully advised in the premises doth order that said report be disapproved and said exceptions sustained in so far as said exceptions are directed to the finding of said Master as to the amount of profits derived by said defendant from the sale of the infringing electrical transformers, and the recommendation of said Master for the entry of a judgment for the amount of profits so found, for the reasons set forth in the opinion of the court this day filed, and in lieu thereof the Court doth now enter a finding upon said accounting for nominal damages in the sum of One Dollar; it is therefore

Considered, Adjudged and Decreed that the decree heretofore entered on February 16th, 1904, including the injunction awarded thereby be and the same are hereby confirmed and made final; and that said complainant do have and recover of said defendant the sum of one dollar so found as aforesaid, and also its costs and charges herein expended upon said accounting for all of which execution may issue as at law.

December 24th, 1907.

DAVID P. DYER, *Judge.*"

And the letters patent in suit having subsequent to the entry of the interlocutory decree, and while the accounting proceedings before the Master were pending, expired, to-wit, on July 12, 1904;

And the cause now coming before the Court for the entry of a final decree, it is

Ordered, Adjudged and Decreed:

1. That letters patent of the United States, issued to George Westinghouse, Jr., for Electrical Converter, dated July 12, 1887, and numbered 366,362, and duly assigned to the complainant, Westinghouse Electric & Manufacturing Company, were good and valid in law, particularly as to the fourth claim thereof during the term of seventeen years from the said 12th day of July, 1887, down to and including the date of their expiration on July 12, 1904, and that the complainant, Westinghouse Electric & Manufacturing Company was the owner of the said letters patent and of all the rights thereunder during the said term of seventeen years.

2. That George Westinghouse, Jr., was the first, true, and original inventor of the invention and improvement set forth in claim four of said letters patent.

3. That the defendant herein, Wagner Electric Manufacturing

703 Company, has infringed the fourth claim of said letters patent, and has infringed the exclusive rights of the complainant under the same by making, using and selling electrical converters or transformers embodying in their construction and principle of operation the invention, substantially as described in said Westinghouse patent, of an electric converter or transformer constructed with open spaces in its core, an enclosing case, and a non-conducting fluid in said case adapted to circulate through said spaces and about the converter or transformer.

4. That the said letters patent and the complainant's rights thereunder, did expire on July 12, 1904.

5. That the complainant is entitled to recover only nominal damages of one dollar because of the defendant's infringement of claim 4 of the said letters patent.

6. That the complainant is not entitled to recover any sum or amount as gains, profits and advantages made, derived or received by the defendant by reason of infringement of claim four of said letters patent in suit.

7. That the perpetual injunction which has heretofore issued out of and in pursuance of the interlocutory decree, and duly served upon the defendant, is declared to be discharged and vacated by reason of the expiration of the letters patent in suit.

8. That the electrical converter or transformer referred to in the proofs in this case and illustrated in printed pamphlet entitled "Wagner Electric Mfg. Co., St. Louis, Mo., U. S. A. Catalogue No. 102, Bulletin 59, 1903", one of complainant's printed exhibits in this case, to-wit, a converter or transformer having open spaces between the coils and between the coils and the core for the circulation of oil, and known as the Wagner Type M. transformer, did not infringe claim 4 of said Westinghouse patent No. 366,362, and that the complainant is not entitled to recover from the defendant any damages or profits by reason of defendant's manufacture, use and sale of such transformers; and that the bill of complaint is dismissed in that regard.

DAVID P. DYER,
U. S. Judge.

Dated St. Louis, Mo., Mch. 5th, '08.

The entry of the foregoing decree is hereby consented to this 5th. day of March, 1908.

FOWLER & BRYSON,
Attorneys for Defendant.

704 United States Circuit Court, Eastern District of Mo., Eastern Division.

No. 4457. In Equity.

WESTINGHOUSE ELECTRIC AND MFG. CO.
vs.
WAGNER ELECTRIC MFG. CO.

It is hereby ordered that the decree this day signed in the above entitled cause be amended before entry by inserting the words "As to matter of form" after the words "Consented to" at the bottom of said decree.

DAVID P. DYER, *Judge.*

March 5th, 1908.

And afterwards, to-wit: on the 13th day of March A. D. 1908, the following further proceedings were had and appear of record in said cause, as follows, to-wit:

(*Order Allowing Appeal.*)

In the Circuit Court of the United States, Eastern Division of the Eastern Judicial District of Missouri.

No. 4457. In Equity.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, Complainant,
vs.
WAGNER ELECTRIC MANUFACTURING COMPANY, Defendant.

Order Allowing Appeal.

Now comes complainant, Westinghouse Electric & Manufacturing Company, by its Solicitors, and files its Assignment of Errors and Petition praying an appeal to the United States Circuit Court of Appeals for the Eighth Judicial Circuit from the final decree entered herein heretofore, to-wit, on the 5th day of March, 1908, as specified in the assignment of errors herewith filed.

Ordered that such appeal be granted, upon complainant's giving an appeal bond in the penal sum of Five Hundred Dollars ($500.00;) thereupon said complainant presents an appeal bond as above provided, which is approved by the Court and filed.

It is further ordered that the Clerk of this Court make out and certify to the United States Circuit Court of Appeals for the Eighth Judicial Circuit a full, true and complete transcript of the record and proceedings in this cause, including transcript of the testimony taken before the Master on the accounting in this cause, the Mas-

ter's report and opinion, and all the records and proceedings in this cause; and it is further ordered that the Clerk of this Court transmit to the Clerk of the United States Circuit Court of Appeals
705 for the Eighth Judicial Circuit all the original exhibits introduced and filed in this cause by complainant and defendant, so that all the original exhibits before this Court which were introduced in evidence before the interlocutory decree, as well as on the accounting before the Master, may be presented to the Circuit Court of Appeals for the Eighth Judicial Circuit.

DAVID P. DYER, *Judge.*

Which said Assignment of Errors, Petition for Appeal and Bond are respectively in words and figures as follows, to-wit:

Assignment of Errors.

In the Circuit Court of the United States, Eastern Division of the Eastern Judicial District of Missouri.

No. 4457. In Equity.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, Complainant.
vs.
WAGNER ELECTRIC MANUFACTURING COMPANY, Defendant.

(Assignment of Errors)

Now comes said complainant, Westinghouse Electric & Manufacturing Company, by Messrs. Bakewell & Cornwall, its Solicitors, and says, that in the record and proceedings and decree in this Court there is manifest error in this, to-wit:

(1.) That the Court erred in that it ordered, adjudged and decreed, as follows:

"That the electrical converter or transformer referred to in the proofs in this case and illustrated in the printed pamphlet entitled 'Wagner Electric Mfg. Co., St. Louis, Mo., U. S. A., Catalogue No. 102, Bulletin 59, 1903', one of complainant's printed exhibits in this case to-wit: a converter or transformer having open spaces between the coils and between the coils and the core for the circulation of oil, and known as Wagner, Type M. transformer, does not infringe claim 4 of said Westinghouse patent No. 366,362, and that as to this last-named electrical converter or transformer the perpetual injunction hereinbefore referred to does not apply."

(2.) That the Court erred in that it ordered, adjudged and decreed as follows:

"That the electrical converter or transformer referred to in the proofs in this case and illustrated in printed pamphlet entitled "Wagner Electric Mfg. Co., St. Louis, Mo., U. S. A. Catalogue

No. 102, Bulletin 59, 1903', one of complainant's printed
706 exhibits in this case to-wit, a converter or transformer having open spaces between the coils and between the coils and the core for the circulation of oil, and known as the Wagner Type M transformer, did not infringe claim 4 of said Westinghouse patent No. 366,362, and that the complainant is not entitled to recover from the defendant any damages or profits by reason of defendant's manufacture, use and sale of such transformers; and that the bill of complaint is dismissed in that regard."

(3.) That the Court erred in that it did not decree that said Wagner Type M transformer is an infringement of claim 4 of the letters patent in suit, No. 366,362.

(4.) That the Court erred in disapproving and setting aside the Master's Report made in this case in and by which the Master found the complainant to be entitled to recover from the defendant, the sum of $132,433.35, which the Master found under the testimony to be the profits of the defendant, made by the defendant, in the manufacture and sale of infringing transformers in respect to which the Court entered an order for an accounting by its interlocutory decree rendered in this cause on February 16, 1904.

(5.) That the Court erred in setting aside and disapproving the Master's Report and ordering that a judgment be entered in favor of complainant "for nominal damages in the sum of one dollar."

(6.) That the Court erred in that it did not award to the complainant the profits made by the defendant by reason of its infringement of claim 4 of the letters patent in suit, No. 366,362.

(7.) That the Court erred in that it did not award to the complainant the profits made by the defendant by the manufacture, use and sale of electric transformers embodying the invention of claim 4 of the letters patent in suit, No. 366,362.

Wherefore the complainant prays that said decree and order of the Court as to the assignment of errors hereinbefore set forth, be reversed.

BAKEWELL & CORNWALL,
KERR, PAGE & COOPER,
Solicitors and Counsel for Westinghouse Electric & Manufacturing Company, Complainant-Appellant.

707 (*Petition for Appeal.*)

In the Circuit Court of the United States, Eastern Division of the Eastern Judicial District of Missouri.

No. 4457. In Equity.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY,
Complainant,
vs.
WAGNER ELECTRIC MANUFACTURING COMPANY, Defendant.

Petition for Appeal.

The above named Westinghouse Electric & Manufacturing Company, complainant, conceiving itself aggrieved by the decree heretofore entered in this case, to-wit: on the 4th day of March, 1907, as more particularly specified by the Assignment of Errors herewith filed, hereby appeals from said decree to the United States Circuit Court of Appeals for the Eighth Circuit, for the reasons specified in the assignment of errors, which is filed herewith; and it prays that this appeal may be allowed, and that a transcript of the record, proceedings and papers upon which said decree was made, duly authenticated, together with all the original exhibits offered in evidence by the complainant and by the defendant in this cause, may be sent to the United States Circuit Court of Appeals for the Eighth Circuit.

BAKEWELL & CORNWALL,
KERR, PAGE & COOPER.
Solicitors for Complainant.

The foregoing petition for appeal is allowed.

DAVID P. DYER, *Judge.*

Appeal Bond.

In the Circuit Court of the United States Eastern Dvision of the Eastern Judicial District of Missouri.

No. 4457. In Equity.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY,
Complainant,
vs.
WAGNER ELECTRIC MANUFACTURING COMPANY, Defendant.

(Appeal Bond.)

Know All Men By These Presents, That we, Westinghouse Electric & Manufacturing Company, and American Surety Company

of New York, as surety, are held and firmly bound unto
Wagner Electric Manufacturing Company in the full and
708 just sum of Five Hundred Dollars ($500), to be paid to the
said Wagner Electric Manufacturing Company; to which
payment well and truly to be made, we bind ourselves jointly and severally by these presents.

Sealed with our seals and dated this seventh day of March, 1908.

Whereas, lately, at a Circuit Court of the United States for the Eastern Division of the Eastern Judicial District of Missouri, in a suit pending in said Court, being Equity Cause No. 4457, between Westinghouse Electric & Manufacturing Company, complainant, and Wagner Electric Manufacturing Company, defendant, a final decree was rendered against the said Westinghouse Electric & Manufacturing Company heretofore, to-wit, on March 5, 1908, as specified in the assignment of errors and petition for appeal in said cause and the said Westinghouse Electric & Manufacturing Company having obtained an appeal and filed a copy thereof in the Clerk's office of the said Court to reverse the said decree in the aforesaid suit, and having obtained a citation directed to the said Wagner Electric Manufacturing Company, citing and admonishing it to be and appear in the United States Circuit Court of Appeals for the Eighth Circuit at the City of St. Louis, Missouri, Sixty days from and after the date of said citation.

Now the condition of the above obligation is such, that if said Westinghouse Electric & Manufacturing Company shall prosecute its appeal to effect and answer all damages and costs if it fail to make its appeal good, then the above obligation to be void; else to remain in full — and virtue.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY.
T. H. GIVEN,
H. S. A. STEWART,
E. M. HERR,
Receivers.
AMERICAN SURETY COMPANY OF NEW YORK,
By RICHARD DEMING,
Resident Vice-President.

Witness:
J. H. JONES.
CHARLES A. TERRY,
Attorney in Fact.

Attest:
PAUL BERGHAUS,
Resident Assistant Secretary, 357.

[SEAL.]

Approved:
DVAID P. DYER, *Judge.*

And afterwards, to-wit: on the 9th day of May A. D. 1908, there was filed in said cause a Stipulation for Transcript on appeal, which said stipulation for transcript is in words and figures, as follows, to-wit:

709 (*Stipulation for Transcript.*)

In the Circuit Court of the United States for the Eastern Division of the Eastern Judicial District of Missouri.

#4457.

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY,
Complainant,
vs.
WAGNER ELECTRIC MANUFACTURING COMPANY, Defendant.

To James R. Gray, Esq., Clerk of said Court:

SIR: In preparing transcript on appeal of the above-entitled cause to the United States Circuit Court of Appeals for the Eighth Circuit, you are hereby requested and directed to include therein none but the following records, pleadings and proofs:

1. Printed record as filed in the Circuit Court;
2. Interlocutory decree and order of reference;
3. Report of Special Master, accompanied by two volumes of proofs taken before him and two volumes of statistics on the accounting;
4. Exceptions of defendant to said report and order of the Court upon same;
5. Final decree;
6. Allowance of appeal and all appeal papers;
7. Opinions of Judges Adams and Dyer;
8. Certificate of the Clerk and that all the exhibits be transmitted intact to said Court of Appeals as required by the order of the Circuit Court entered March 13th, 1908.

BAKEWELL & CORNWALL,
Solicitors for Complainant.

We consent to the foregoing præcipe.

FOWLER & BRYSON,
Solicitors for Defendant.

And afterwards, to-wit: on the 18th day of May A. D. 1908, there was filed in said cause a Præcipe as to Transcript which is in words and figures, as follows, to-wit:

(*Præcipe as to Transcript.*)

In the Circuit Court of the United States for the Eastern Division of the Eastern Judicial District of Missouri.

710 #4457.

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY,
Complainant,
vs.
WAGNER ELECTRIC MANUFACTURING COMPANY, Defendant.

To James R. Gray, Clerk of said Court:

SIR: Whereas, the report of the Master on accounting in the above-entitled cause was accompanied by two typewritten volumes of tabulated statistics, the first being paged from 1 to 183 and the second from 1-*a* to 183-*a*, and

Whereas, it appears from the Master's report, as well as from the said two volumes themselves, that they are to be read across when placed side by side, so that page 1-*a* is in fact but a continuation on the right hand side of page 1, page 2-*a* of page 2, etc.;

Now Therefore, in preparing the transcript on appeal of said cause to the U. S. Circuit Court of Appeals for the Eighth Circuit you are hereby requested and directed to attach page 1-*a* at the right hand side of page 1 so that the line may be read across the two pages as near as may be, page 2-*a* at the right of page 2, and so on through the two volumes, page 183-*a* being attached to the right hand side of page 183.

May 16th, 1908.

(Signed) PAUL BAKEWELL,
Solicitor for Complainant.

(*Opinion of Court on Interlocutory Decree.*)

In the Circuit Court of the United States for the Eastern Division of the Eastern District of Missouri.

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY,
Complainant,
vs.
WAGNER ELECTRIC MANUFACTURING COMPANY, Defendant.

ADAMS, *District Judge:*

This is a suit based on the 4th claim of letters patent of the United States, No. 366,362 granted to complainant assignor July 12, 1887, for new and useful improvements in electric converters. The relief asked for is an injunction restraining the defendant from infringing the claim and an accounting. The patent has been in litigation before.

On May 10, 1900, complainant instituted a suit on the same patent in the Circuit Court of the United States for the Northern District of New York against the Union Carbide Company, which will hereafter be referred to as the Carbide Company.

711 The defendant in this case being the manufacture of the device claimed to constitute an infringement in the Carbide case, appeared and conducted the defense, and it is conceded is bound by the decree therein rendered. Before final submission of that case complainant dismissed as to claims 1, 2, 3 and 5, submitting claim 4 only to the final judgment of the court. The defenses to that action were want of patentable invention and non-infringement. The trial court decided that claim 4 of the patent was valid, and that defendant had infringed the claim by manufacturing the device then before the court, and this decree was affirmed by the Circuit Court of Appeals for the Second Circuit.

The present action is based on the same claim (4) and no controversy is now made except on the issue of infringement. Defendant contends that this present device is so different from the device involved in the Carbide case, that the judgment in that case is not res adjudicata of the present issue of infringement, and that in fact the defendant's device does not infringe claim 4. The only question for decision therefore is: whether the defendant's device constitutes an infringement of claim 4 of the patent in suit. The invention of the patent relates according to the specifications "to the construction of a class of apparatus employed for transforming alternating or intermittent electric currents of any required character into currents different therefrom in certain characteristics," and the object of the invention according to the specification is "to provide a simple and efficient converter which will not become over heated when employed for a long time in transforming current of high electro motive force, and which will be thoroughly ventilated." The claim in question is as follows:

(4) "The combination, substantially as described, of an electric converter constructed with open spaces in its core, an inclosing case, and a non-conducting fluid or gas in said case adapted to circulate through said spaces and about the converter."

Complainant claims that the converter, now commonly called a transformer, manufactured by the defendant, infringes claim 4 in three particulars:

First: because there is an open space between the coils themselves.

Second: because there is a rectangular opening inside of the core through which the coils pass, and

Third: because there are open spaces between the core and the coils. The question for determination is: whether either of these three spaces or openings constitute "open spaces in its core" within the true meaning of claim 4 of the patent.

712 I have reached the conclusion that the defendant's transformer does not, by reason of either one or all of the above mentioned features, have "open spaces in its core" within the true meaning of the patent in suit, for the following reasons:

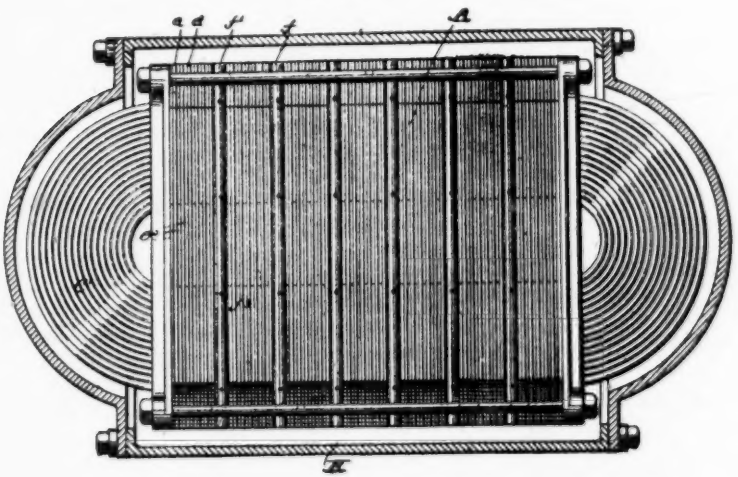
First: The fact that there is a space between the two coils when inserted in the core is not an infringement of claim 4 for the most obvious reason that claim 4 calls for no such space, and for the quite equally obvious reason that claim 1 which is not now in controversy does contain that element.

From these two facts it is altogether probable that the patentee did not himself understand or intend that claim 4 should be construed as containing the element.

After a careful reading of the opinion of the Court of Appeals in the Carbide case, 117 Fed. 495, (which it is conceded by counsel to be binding upon the defendant in this case) I find no reason for reading the element of "open space between the coils" into claim 4.

Second: The drawings and description of complainant's patent as well as the model shown in evidence and used in argument show a device in which the coils completely fill the opening in the surrounding core and in which parallel open spaces a few inches apart appear in the substance of the core, extending throughout its body in such way as to permit the coil in which the transformer is submerged to freely circulate about the surrounding core and into the interior. A longitudinal section of this device is shown in Fig. 2 of the drawings of the patent, which is as follows:

Fig 2.



713 These numerous parallel open spaces so shown in the drawings and model and any other open spaces whether parallel or not cutting through the body of the surrounding core and extending into the interior opening containing the coils, are in my opinion the "open spaces in its core" contemplated by claim 4. The purpose of these open spaces as disclosed by the patent and the evidence of experts is: to permit the oil to so bathe the heat-producing surfaces

of the transformer, and to so circulate throughout the parts of the transformer, as to preserve the insulation of the coils and radiate the heat generated by the transformer's action.

The use of oil or paraphine in a tank inclosing the transformer for the purpose just specified has been long known to the art and is recognized by at least two patents prior in date to complainant's patent.

Accordingly, the inventor has for its main purpose only the physical means for effectually securing this circulation of oil. It deals with the core itself and divides it up into groups of plates, each group separate from the other in such way as to make numerous parallel open spaces in the core leading from its outer surface on all its four sides into the interior opening made for the introduction of the coils. This interior opening called in the patent "two rectangular openings e^1 and e^2 through which the wires pass" is not in my opinion "an open space in its core" within the meaning of claim 4.

I adopt the views of Prof. Nipher with respect to this rectangular opening. He says: "The core is not the core of a transformer or converter until these rectangular openings are made through it." He says further: "These openings give character to the core." "It is not a core until they exist there." The core is in fact given such a form that it surrounds the coil in a certain sense, and the space so surrounded by the core might be called a coil opening." The core of a transformer is the iron part of it. It must be so constructed as to permit the introduction of the coils of wire approximately through its center. The wire coil must be put in to make a transformer. I cannot understand how this space left in the inside of the iron for this purpose can be an open space in the core. It might be as well said that the space left on the outside of the iron, between it and the incasing tank, is an open space in the coil.

The defendant's device has a space between the coils and has also this rectangular opening for the introduction of the coils into the core, but for the reasons above expressed, these are not "open spaces in its core" within the meaning of the patent in suit.

714 Third: The defendant's device also has certain open spaces between the core and the coils as shown in its model in evidence. The complainant's device has no such spaces. Complainant's core hugs the coils closely and thereby secures greater efficiency of action. But it is contended that these spaces betwen the core and the coils are the mechanical equivalent of the spaces in the core already considered. I cannot agree to this view of the case. They are physically two different things. One (the complainant's) has the spaces cutting the core throughout its whole substance, thus permitting the oil to percolate copiously into all heat-producing surfaces. The other (The defendant's) has its spaces inside the core between its inner surface and the outer surface of the coils, thereby releasing the grasp of the core upon the coils and decreasing the efficiency of its transforming action.

If the patent in suit were a broad and valid patent for a circulatory system throughout the heat-producing parts of a trans-

former, the two devices might be the mechanical equivalent, but it is not such a patent. It is distinctly a patent for a machine involving physical elements, and I cannot bring myself to think the spaces of the defendant's device between the core and the coils are the same as the open spaces in the core of complainant's device, or the mechanical equivalent thereof. They may perform the same function, but they do it by means of different physical elements and the defendant's device is constructed at the expense of efficiency which the complainant's device avoids.

The problem for years before the grant of complainant's patent was to devise efficient means for cooling the heat producing surfaces of the transformer, and for protecting the insulation of the coils.

The complainant invented the physical means shown by claim 4. The defendant adopted the totally different physical means shown in its model. In view of the foregoing I cannot construe the opinion in the Carbide case as giving the complainant the monopoly of all means by which the external and internal surfaces of the heating-producting parts of a converter can be cooled. This view would preclude the use of any and every other device looking toward the accomplishment of the main object, namely: the circulation of oil throughout the heat-producing parts of a converter. The opinion in that case uses the language that the patentee was "entitled to claim the means for accomplishing that object, manifestly referring to the means claimed in claim 4 and described in the patent, namely: of opening up the core itself in the way
715 already pointed out leaving all other means (not the mechanical equivalent however) open to the free use of the public.

I think the construction which I have already placed on claim 4 is the one which complainant itself placed upon that claim for years and in fact until the Spring of 1903, when it moved in this case for a rule to punish the defendant for contempt.

In 1887 on the same date the patent in suit was granted, the patentee George Westinghouse, Jr., secured a British Patent for a device of similar construction to that employed in the defendant's transformer.

The drawings and claims of that British Patent show a transformer with open spaces between the coils and between the coils and the core. Claims 10 and 11 of that patent distinctly call for "strips of insulating material extending along the sides of the coils and separating the same from the surrounding core."

The American and British were applied for and secured at the same time. Accordingly, it is obvious that the patentee had in mind the construction involved now in defendant's device, and he deemed it important enough to be made the subject of a separate patent. To give him now the monopoly of this construction by virtue of his American Patent would, in my opinion give him something which he intentionally failed to claim when he secured it, and which he obviously then thought should be specifically claimed in order to secure it.

Again it clearly appears that the defendant was engaged in making its transformer for some years prior to the hearing of the Carbide

case, and that the witnesses in that case knew of this fact. They certainly knew that defendant was manufacturing a transformer with open spaces between the coils and a rectangular opening into the core for the insertion of the coils. But no attempt was there made to hold these features to be an infringement of claim 4 of the patent. Complainant there contented itself by claiming the parallel open spaces throughout the core itself, to be an infringement.

After the judgment was rendered in that case, the complainant with full knowledge that the defendant was manufacturing transformers with the open spaces and openings now claimed to be an infringement of claim 4, never sought to hold the defendant guilty of contempt for violation of the injunctive order in that case.

716 After that injunctive order became final the defendant conformed thereto by changing its transformer so as to close up all the parallel open spaces throughout the core itself, leaving the core one solid mass of iron plates with no open spaces in it, but retaining in its structure the open spaces between the coils and between the core and coils as before, and has continued to manufacture such transformers, so modified, from that day to this.

The proof shows no claim that the use of this modified structure constituted a violation of the injunctive order in that case.

Soon afterwards the present suit was instituted and a preliminary injunction was granted against the defendant restraining it from infringement. This restraining order was consented to by defendant under the belief that it related exclusively to the same kind of a transformer which was declared an infringement in the Carbide case, and I am satisfied that counsel on both sides so regarded it at the time.

In due time after the institution of this suit the defendant filed an answer admitting that the judgment in the Carbide case was an estoppel against it as to the validity of claim 4, and consenting to a final decree enjoining it from infringing that claim. At about this juncture complainant and defendant by counsel came to an understanding that neither party should take any evidence until further notice. The case remained in this condition for about a year, and in the meantime defendant refrained from manufacturing or selling the transformer condemned as an infringement in the Carbide case, but continued to manufacture and sell the transformer now claimed to be an infringement. This condition of things remained until May 1903, when a motion was made to punish defendant for contempt on the ground that the manufacture and sale of its present transformer was a violation of the preliminary injunction granted in this case. This motion was denied and since then proofs have been taken and the cause is now submitted for a final decree. All of these facts convince me that complainant's present claim that defendant's present transformer is an infringement of claim 4 of its patent, is an afterthought on its part, and that from the date of its British Patent in 1887, to the date of filing the motion to punish defendant for contempt in May 1903 the complainant continuously interpreted claim 4 of its patent as not covering the defendant's device now in question.

This seems to me to be such a contemporaneous and continuous construction put upon claim 4 of the patent by complainant, and one upon which defendant has innocently acted, that complainant ought to be estopped at this late date from asserting to the contrary.

The patent in suit has only about five months longer to run. It expires on June 12th of this year. To now enjoin the defendant after it has been manufacturing, selling and advertising the transformers complained of for a period of about eight years, as shown by the testimony, and under circumstances disclosed by this record, would in my opinion be grossly inequitable. My conclusions are:

First. That the transformer now being used by the defendant is not within the true meaning of the patent itself an infringement of claim 4.

Second. The construction which I have placed upon this claim is in harmony with the cotemporaneous and continuous construction placed upon the same claim by the patentee himself, and by the complainant.

Third. The complainant by its own conduct is estopped from claiming the contrary.

The decree will be that the defendant be enjoined from manufacturing or selling the transformer like that declared an infringement in the Carbide case, and for the usual accounting, but it will be so framed as to exclude from its operation the transformer now manufactured by the defendant which has afforded the only issue before the court in this case.

I am not disposed to work out the question of costs though the statute relating to disclaimer, (Sec. 4922 Revised Statutes of the United States) as that involves a lengthy consideration of the question whether the complainant should not before bringing this suit have entered a disclaimer as to claims 1, 2, and 5 of the patent.

I think the equity of the matter can be reached by a direct order concerning the costs. The complainant had a right as long as the defendant was making use of the transformer adjudged to be an infringement in the Carbide case, to institute its suit for an injunction and accounting by reason thereof, and notwithstanding the fact that defendant admitted the infringement in its answer, the complainant should not be adjudged to pay all the costs of this proceeding. I think an equitable disposition of this matter is to require each of the parties to pay its own costs and It Will Be So Ordered.

718 (*Opinion of Court on Exceptions to Report of Special Master on Accounting.*)

In the United States Circuit Court, Eastern Division, Eastern District of Missouri.

No. 4457.

WESTINGHOUSE ELECTRIC MNFG. CO., Complainant,
vs.
WAGNER ELECTRIC MNFG. CO., Defendant.

DYER, *J.*:

On the 16th day of February, A. D. 1904, this Court (Judge Adams presiding) made and caused to be entered the following decree:

"In the United States Circuit Court, Eastern Division, Eastern District of Missouri.

No. 4457. In Equity.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, Complainant,
vs.
WAGNER ELECTRIC MANUFACTURING COMPANY, Defendant.

Interlocutory Decree.

This cause having come on to be heard upon the pleadings and proofs herein,

It Is Ordered, Adjudged and Decreed, as follows:

That letters patent of the United States issued to George Westinghouse Jr., for Electrical Converter, dated July 12, 1887, and numbered 366,362, and duly assigned to the complainant, Westinghouse Electric & Manufacturing Company, are good and valid in law, particularly as to the fourth claim thereof, and that complainant, Westinghouse Electric & Manufacturing Company, is the owner of said letters patent and all rights thereunder.

That George Westinghouse Jr., was the first, true and original inventor of the inventions and improvements described and claimed in claim 4 of said letters patent.

That the defendant herein, Wagner Electric Manufacturing Company, has infringed the fourth claim of said letters patent, and upon the exclusive rights of the complainant under the same, by making, using and selling electrical converters or transformers embodying in their construction and principle of operation the combination, substantially as described in said Westinghouse patent, of an electric converter or transformer constructed with open spaces in its core,

an enclosing case, and a non-conducting fluid in said case adapted to circulate through said spaces and about the converter or transformer.

719 That complainant do recover of the defendant the profits, gains and advantages which the said defendant has derived, received or made by reason of said infringement by said defendant of claim 4, of the said Westinghouse patent No. 366,362, and that the complainant do recover of the said defendant any and all damages which the complainant has sustained by reason of said infringement by said defendant in the manufacture, use or sale of electrical transformers or converters found to be in infringement of claim 4 of said Westinghouse patent No. 366,362, as hereinbefore specified, or any electrical converters or transformers which embody in their construction and principle of operation the combination, substantially as described in said Westinghouse patent of an electrical converter or transformer constructed with open spaces in its core, an enclosing case, and non-conducting fluid or gas in said case adapted to circulate through the spaces and about the converter.

And this cause is hereby referred to Henry H. Denison, Esq., as Special Master, to take and state an account of said gains, profits and advantages, to assess such damages, and to report thereon with all convenient speed; and that the defendant herein, said Wagner Electric Manufacturing Company, its directors, officers, attorneys, clerks, servants and workmen are hereby directed to attend before said Master from time to time as required, and to produce before him such books, papers, vouchers and documents and to submit to such oral examination as the Master may require.

That a perpetual injunction issue out of and under the seal of this Court, directed to said defendant, Wagner Electric Manufacturing Company, its officers, directors, agents, attorneys, clerks, servant- and workmen, enjoining and restraining them, and each of them from directly or indirectly making or causing to be made, using, or causing to be used, or vending to others to be used, in any manner, any electrical converters or transformers containing, embodying or employing the said inventions or improvements, claimed by the fourth claim thereof, or from infringing or violating said letters patent No. 366,362, as to the fourth claim thereof, in any manner whatsoever.

And the Court having heard counsel for complainant and counsel for defendant herein, after due consideration,

It Is Further Ordered, Adjudged and Decreed

That the electrical converter or transformer referred to in the proofs in this case and illustrated in the printed pamphlet entitled "Wagner Electric Mfg. Co., St. Louis, Mo., U. S. A., Cata-

720 logue No. 102, Bulletin 59, 1903," one of complainant's printed exhibits in this case; to-wit: a converter or transformer having open spaces between the coils and between the coils and the core for the circulation of oil, and known as Wagner, Type M. Transformer, does not infringe claim 4 of said Westinghouse patent No. 366,362, and that as to this last-named electrical con-

verter or transformer the perpetual injunction hereinbefore referred to does not apply.

And that neither party recover any costs in this action up to and including the entry of this interlocutory decree, but, that in respect to the costs in this action up to and including the entry of this interlocutory decree, each party pay its own costs.

ELMER B. ADAMS, *Judge.*"

St. Louis, February 16, 1904.

This decree, as it will be seen, contains the following:

"That complainant do recover of the defendant the profits, gains and advantages which the said defendant, has derived, received or made by reason of said infringement by said defendant of claim 4 of the said Westinghouse patent No. 366,362, and that the complainant do recover of the said defendant any and all damages which the complainant has sustained by reason of said infringement by said defendant in the manufacture, use or sale of electrical transformers or converters found to be in infringement of claim 4 of said Westinghouse patent No. 366,362, as hereinbefore specified or any electrical converters or transformers which embody in their construction and principle of operation the combination, substantially as described in said Westinghouse patent, of an electrical converter or transformer constructed with open spaces in its core, an enclosing case, and non-conducting fluid or gas in said case adapted to circulate through the spaces and about the converter."

This would seem to limit the amount of the recovery to "the profits, gains and advantages which the said defendant has derived, received or made by reason of said infringement by defendant of claim four of patent "366,362."

The Master named in the decree proceeded to a hearing and much testimony was taken before him both in behalf of the complainant and of the defendant. At the close of complainant's testimony a demurrer to the evidence was interposed by the defendant to the case on the ground chiefly that the evidence did not show or tend to show that the complainant has sustained any damage whatever by reason of the defendant having reaped any profits by the sale of the infringing device known as claim four of the patent.

721 In over-ruling this demurrer the Master said:

"It seems to me that the Complainant has made out a prima facie case, his testimony having been directed in the main to the right to recover for profits made upon the entire converter. The motion as made by the defendant, that the Master should rule that the complainant was entitled to only nominal damages on the prima facie case, it seems to me goes too far in asking the Master to separate the damages which the complainant would be entitled to recover for the entire converter from the damages which he would be entitled to recover under claim four, when neither the defendant nor the complainant have either of them produced any evidence to show to the Master that the damages should be confined to Claim Four, and showing what, if anything, those damages should be as

distinguished from the damages which would result from the infringement growing out of the manufacture of the entire converter. It seems to me, in the present aspect of the case, that it is the province of the defendant now, if he is able to do so to show that whatever profits have resulted from the use of the converter, as shown in the testimony heretofore, should be confined to nominal damages resulting from the use of Claim Four alone, as distinguished from the entire converter, provided any damages can be shown to have resulted from the use of Claim Four alone. In other words, I do not think the testimony in the case is in such shape that the Master can properly distinguish between the damages as attempted to be shown for the use of the entire converter, and the damages which have not been shown at all, for the use of Claim Four alone, distinguished from the entire converter.

Mr. FOWLER: Does your Honor rule that the complainant has shown profits due to Claim Four of the patent in suit?

The MASTER: I have just indicated that on the present condition of the testimony, it is impossible for me to distinguish between the damages which have resulted or have been shown as resulting from the use of the entire converter, and damages for the use of Claim Four alone. There is no testimony before me, up to this time, which will enable me to draw any conclusions upon that point. There has been no testimony before me showing what the damages might be for the use of Claim Four alone. That is to say, what have been the profits earned by the defendant from the use of Claim Four, as segregated from the entire converter.

Mr. FOWLER: Does your Honor rule that the seventy-five thousand odd dollars profits claimed by the complainant are the profits on the entire converter?

722 The MASTER: I think my previous statements cover that quite completely. The only testimony before me with regard to profits derived from the infringement relates to profits resulting from the manufacture of the entire converter, embracing within its construction Claim Four.

Mr. FOWLER: Does your Honor rule that the complainant has not shown what part, or any part, of the seventy five thousand odd dollars profits claimed by it is due to the patented invention, to-wit: to Claim Four of the patent in suit?

The MASTER: I have tried to make it clear that the testimony so far as it has been produced before me, goes to establish the claim of profits resulting from the manufacture of the entire converter, which embraces within its construction Claim 4; that there has been [80] separation, in the testimony, of the amount of the profits which would result exclusively and solely from the use of Claim Four, I have also tried to make clear. The complainant, so far as the case has proceeded before me, is claiming the recovery of profits which have resulted from the manufacture of the entire converter, and for the reason that the manufacture of those converters include within their construction Claim Four, which the court has heretofore held has been infringed by the defendant. Now until testimony is produced before me, showing that the profits which have resulted from

the use of Claim Four are other and different from the profits which the complainant claims to be entitled to recover for the manufacture and use of the entire converter, which embrace Claim Four, it seems to me I am not at liberty to find that the complainant is entitled to recover only nominal damages, from the simple fact that he has not made that distinction in the testimony."

The evidence taken upon the part of the defendant threw no further light upon the question as to what profits, if any, were derived by the defendant from the sale of the device covered by claim Four of the patent. The result of the report is embraced in the following words of the Master:

"The Complainant is entitled to recover the sum of $132,433.35, which I find under the testimony to be the profits of the defendant from the manufacture and sale of the infringing transformers."

This sum is the result of a calculation made by the Master of profits derived from the sale of transformers (in which and a part of which was the device covered by claim four of the patent) by the defendant within certain periods. The Master arrives at this result in the manner following:

723 "Gross sales after deducting commissions—$874,060.15.

(Credits.)

Labor and material	$529,733.43	
Factory cost	211,8939.37	
		$741,626.80
Profits		$132,433.35

The order of the Court made by Judge Adams limited the recovery to the profits, gains and advantages which the defendant made by reason of infringement of claim four of complainant's patent #366,362.

The burden of proof was upon the complainant to show by competent evidence that the defendant had realized profits and advantages by reason of the infringement of claim four.

The Master recommends a judgment against the defendant for all the profits derived by it from the sale of all the transformers made and sold by the defendant within a certain period regardless of what per cent., if any, the patented device (claim four) bore to the whole. This in my judgment was beyond the scope of inquiry contained in the order of reference and cannot be upheld. The demurrer of the defendant at the close of complainant's case should have been sustained. The Master's report will be disapproved and set aside, and a judgment will be entered in favor of the complainant for nominal damages (one dollar) only and the costs of this proceeding.

Other objections have been urged to the report of the Master, but in the view herein taken it is not necessary to discuss or decide them.

UNITED STATES OF AMERICA,
Eastern Division of the Eastern Judicial District of Missouri, ss:

I, James R. Gray, Clerk of the Circuit Court of the United States in and for the Eastern Division of the Eastern Judicial District of Missouri, do hereby certify that the above and foregoing is a full, true and complete transcript of the record and proceedings in the cause therein entitled, (save as restricted by the stipulation for transcript therein set forth), as fully as the same remains on file and of record in said cause in my office; and that the original Citation is hereto attached and herewith returned.

724 In Witness Whereof I hereunto set my hand and affix the seal of said Court at office in the City of St. Louis, in said Division of said District, this eleventh day of May A. D. 1908.

[Seal U. S. Circuit Court, Eastern Division, Eastern Judicial District of Missouri.]

JAMES R. GRAY,
Clerk of Said Court.
IRVINE MITCHELL,
Deputy Clerk.

Filed May 21, 1908. John D. Jordan, Clerk.

UNITED STATES OF AMERICA,
Eastern Division of the Eastern Judicial District of Missouri, ss:

In the Circuit Court of the United States in and for the Division and District Aforesaid.

Be It Remembered: that heretofore to-wit: on the 29th day of July, A. D. 1908 there was filed in the office of the Clerk of the Circuit Court of the United States in and for the Eastern Division of the Eastern Judicial District of Missouri, a stipulation in a cause pending in the said Court, entitled Westinghouse Electric & Manufacturing Company, Complainant vs. Wagner Electric Manufacturing Company, Defendant, In Equity No. 4457, which said stipulation is in words and figures as follows: to-wit:

(*Stipulation for Supplemental Transcript.*)

United States Circuit Court, Eastern Division of the Eastern District of Missouri, Eighth Circuit.

No. 4457. In Equity.

WESTINGHOUSE ELECTRIC & MANUFACTURING CO., Complainant,
vs.
WAGNER ELECTRIC MANUFACTURING CO., Defendant.

Stipulation.

It is stipulated by and between counsel for complainant appellant and counsel for defendant-appellee as follows:

That the transcript of the record in this case, as the same is on file with the Clerk of this Court, may be amended by the Clerk of the United States Circuit Court for the Eastern Division of the Eastern Judicial District of Missouri, by the Clerk of said Circuit Court certifying to the Clerk of this Court true copies of the following named exhibits which were offered in evidence before the Special Master, Henry H. Denison; that is to say, true copies of the following named exhibits:

725 Complainant's Exhibit Blueprint A, Henry H. Denison, Master.

Complainant's Exhibit Blueprint B, Henry H. Denison, Master.

BAKEWELL & CORNWALL,
Solicitors and of Counsel for Complainant-Appellant, Westinghouse Electric & Manufacturing Company.

A. C. FOWLER,
Solicitor and of Counsel for Defendant-Appellee, Wagner Electric Manufacturing Company.

St. Louis, Mo., July 28, 1908.

726 The Exhibits referred to in the above stipulation are in words and figures as follows:

(Here follow blue prints marked pages 727-729.)

Estimated Manufacturing Cost of Type G. 1-2000 / 1-200 Volt, Standard Transformers.

Size Trans	One Sec. Coil.	One Pr. Coil	Case and Lid	One Pair Hangers	End Plates	Int. Ch. Dev.	Assembled Coil	Mounted Coil	Boxed Trans.	Packed Trans.
2	1.53	2.58	4.68	.73	.50	.28	8.48	11.26	17.63	18.75
4	1.88	2.45	4.90	.73	.50	.28	9.13	13.23	19.81	2096
6	2.30	3.12	5.24	.73	.64	.28	11.10	15.89	23.03	24.22
8	2.30	2.76	5.73	.73	.64	.42	10.79	16.69	24.75	26.05
12	3.04	2.35	7.07	.81	1.06	.42	17.26	24.47	34.48	36.16
16	4.17	2.60	7.24	.81	1.06	.42	19.26	27.79	38.18	40.00
20	4.45	3.29	9.18	.87	1.76	42	22.39	33.08	45.64	48.23

Trans	Coil.	Coil	Lid	Hangers		Dev.	Coil	Coil		
2	1.53	2.58	4.68	.73	.50	.28	8.48	11.26	17.63	18.75
4	1.88	2.45	4.90	.73	.50	.28	9.13	13.23	19.81	2096
6	2.30	3.12	5.24	.73	.64	.28	11.10	15.89	23.03	24.22
8	2.30	2.76	5.73	.73	.64	.42	10.79	16.69	24.75	26.05
12	3.04	2.35	7.07	.81	1 06	.42	17.26	24.47	34.48	36.16
16	4.17	2.60	7.24	.81	1.06	.42	19.26	27.79	38.18	40.00
20	4.45	3.29	9.18	.87	1.76	42	22.39	33.08	45.64	48.23
25	5.03	3.32	9.95	.87	1.76	.42	23.81	36.44	50.23	52.88
30	5.50	4.91	12.99	1.12	2.25	.63	30.86	44.55	69.41	72.21
40	6.34	5.63	13.76	1.12	2.25	.63	35.74	60.47	81.91	84.92
60	7.90	6.61	14.95	1.12	2.25	.63	42.87	65.44	86.51	88.65
80	12.61	7.41	30.94	X	6.57	.63	57.69	86.46	130.73	133.64
100	14.49	8.65	33.67	X	6.61	.63	66.84	98.57	145.59	148.85
120	15.61	9.10	34.44	X	6.62	.63	68.17	108.14	155.90	159.31
160	20.89	11.66	45.29	X	8.46	.63	92.90	133.71	195.89	199.64
200	24.16	11.90	50.68	X	8.50	.63	108.29	154.45	222.10	225.85

Note

Added 40 o/o to sum of material and labor.

Cost of strip ---------- 2½¢.

Cost of castings ---------- 5¢.

Cost of sheet iron -------- 4½¢.

Cost of wire ---------- market prices.

COMPLAINANTS EXHIBIT "A" BLUE PRINT HENRY H. DENISON, Master

Wagner Electric Mfg. Co.

Trans. Eng. Dept. June 26, 1900.

Endorsed: Filed July 30" 1907. James R. Gray, Clerk.

Estimated Manufacturing Cost of Type G, 1-2000 1-200 Volt, Standard Transformers.

Size Trans.	One Sec. Coil	One Pr. Coil	Case and Lid	One Pair Hangers	End Plates	Int. Ch. Dev.	Assembled Coil	Mounted Coil	Boxed Trans.	Packed Trans.
F-2	.94	1.71	3.00	.52	.35	.20	5.45	7.15	9.72	10.43
G-2	1.04	1.91	3.34	.52	.35	.20	6.05	7.98	10.80	12.97
4	1.32	1.86	3.50	.52	.35	.20	6.59	9.44	13.29	14.04
6	1.61	2.28	3.57	.52	.45	.20	7.97	11.25	17.05	17.83
8	1.73	2.08	4.10	.52	.45	.30	7.93	11.95	19.52	20.45
12	2.60	1.53	5.06	.58	.75	.30	12.62	17.60	23.60	24.70
16	3.50	1.68	5.16	.58	.75	.30	14.09	19.90	27.72	28.96
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

	Coil	Coil	Lid	Hangers		Rev.	Coil	Coil		
F-2	.94	1.71	3.00	.52	.35	.20	5.45	7.15	9.72	10.43
G-2	1.04	1.91	3.34	.52	.35	.20	6.05	7.98	10.80	12.97
4	1.32	1.86	3.50	.52	.35	.20	6.59	9.44	13.29	14.04
6	1.61	2.28	3.57	.52	.45	.20	7.97	11.25	17.05	17.83
8	1.73	2.08	4.10	.52	.45	.30	7.93	11.95	19.52	20.45
12	2.60	1.53	5.06	.58	.75	.30	12.62	17.60	23.60	24.70
16	3.50	1.68	5.16	.58	.75	.30	14.09	19.90	27.72	28.96
20	3.73	2.10	6.55	.62	1.26	.30	15.27	23.61	31.96	33.20
25	4.20	2.13	7.11	.62	1.26	.30	17.27	26.05	35.66	37.00
30	4.63	3.47	9.27	.80	1.61	.45	22.32	31.58	49.57	51.42
40	5.34	3.66	9.82	.80	1.61	.45	25.92	43.03	50.70	52.70
60	6.67	4.53	10.67	.80	1.61	.45	31.21	46.58	57.99	60.12
80	10.67	5.10	22.10		4.71	.45	42.71	62.35	96.76	98.69
100	12.30	5.94	24.05		4.71	.45	49.43	70.92	104.10	106.26
120	12.02	6.27	24.60		4.71	.45	50.28	77.50	113.02	115.27
160	17.85	8.02	32.35		6.07	.45	68.78	96.58	144.26	146.72
200	20.60	9.66	36.20		6.07	.45	81.78	113.14	166.90	169.42
V.M.	.72	1.32	2.32	.40	.28	.16	4.22	5.50	7.15	7.68

Cost of Strip ---------- 21¢
Cost of castings -------- 5¢
Cost of sheet iron ------- 4.5¢
Cost of wire ---------- market prices.
These costs are without per cents added.

This volt-meter is out-door type.

COMPLAINANT'S EXHIBIT "BLUE PRINT B" HENRY H. DENISON MASTER

Wagner Electric Mf'g. Co.

Trans. Eng. Dept. **July 31, 1900.**

Endorsed: Filed July 30th 1907. James R. Gray, Clerk

730 UNITED STATES OF AMERICA,
Eastern Division of the Eastern
Judicial District of Missouri, ss:

I, James R. Gray, Clerk of the Circuit Court of the United States in and for the Eastern Division of the Eastern Judicial District of Missouri, do hereby certify that the foregoing is a full, true and complete supplemental transcript of the record and proceedings in the cause therein entitled, as restricted and designated by the stipulation for such supplemental transcript hereinbefore set forth, as fully as the same remain on file and of record in my office.

In Witness Whereof I hereunto set my hand and affix the seal of said Circuit Court at office in the City of St. Louis in said Division of said District, this fifth day of August A. D. 1908.

JAMES R. GRAY,
Clerk of said Court.
By IRVINE MITCHELL,
Deputy Clerk.

[Seal U. S. Circuit Court, Eastern Division, Eastern Judicial District of Missouri.]

No. 2857. Westinghouse Electric and Manufacturing Company, Appellant, vs. Wagner Electric and Manufacturing Company. Supplemental Transcript of Record from U. S. Circuit Court.

Filed Aug. 6, 1908. John D. Jordan, Clerk.

731 *(Clerk's Certificate to Printed Record.)*

United States Circuit Court of Appeals, Eighth Circuit,

I, John D. Jordan, Clerk of the United States Circuit Court of Appeals for the Eighth Circuit, do hereby certify that the foregoing printed record in the case of Westinghouse Electric and Manufacturing Company, Appellant, vs. Wagner Electric and Manufacturing Company, No. 2857, was printed under my supervision and is identical with the printed record upon which said cause was heard and decided in said Circuit Court of Appeals.

In Testimony Whereof, I hereunto subscribe my name and affix the seal of the United States Circuit Court of Appeals for the Eighth Circuit, at office in the City of St. Louis, Missouri, this twenty-fourth day of November, A. D. 1909.

[Seal United States Circuit Court of Appeals, Eighth Circuit.]

JOHN D. JORDAN,
Clerk of the United States Circuit Court of
Appeals for the Eighth Circuit.

Pleas and proceedings in the United States Circuit Court
732 of Appeals for the Eighth Circuit, at the May Term, 1909, of said Court, before the Honorable Walter H. Sanborn and the Honorable Willis Van Devanter, Circuit Judges, and the Honorable John A. Riner, District Judge.

[Seal United States Circuit Court of Appeals, Eighth Circuit.]

Attest:

JOHN D. JORDAN,
Clerk of the United States Circuit Court of Appeals for the Eighth Circuit.

Be it Remembered that heretofore, to-wit: on the twenty-first day of May, A. D. 1908, a transcript of record, pursuant to an appeal allowed by the Circuit Court of the United States for the Eastern District of Missouri, was filed in the office of the Clerk of the United States Circuit Court of Appeals for the Eighth Circuit, in a certain cause wherein the Westinghouse Electric and Manufacturing Company was Appellant and the Wagner Electric and Manufacturing Company was Appellee, which said transcript of record was filed and docketed in said Circuit Court of Appeals as No. 2857.

That thereafter the following proceedings were had in said cause, in said Circuit Court of Appeals, viz:

733 On the twenty-first day of May, A. D. 1908, the appearance of counsel for appellant was filed in said cause, in the words and figures following to wit:

(*Appearance of Counsel for Appellant.*)

United States Circuit Court of Appeals, Eighth Circuit.

No. 2857.

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY,
Appellant,
vs.
WAGNER ELECTRIC AND MANUFACTURING COMPANY.

The Clerk will enter my appearance as Counsel for the Appellant.

THOMAS B. KERR.
DRURY W. COOPER.
PAUL BAKEWELL.

(Endorsed:) U. S. Circuit Court of Appeals, Eighth Circuit. No. 2857. Westinghouse Electric and Manufacturing Co., Appellant, vs. Wagner Electric and Manufacturing Company. Appearance. Filed May 21, 1908, John D. Jordan, Clerk. Thomas B. Kerr, Drury W. Cooper, Paul Bakewell, Counsel for Appellant.

And on the eleventh day of September, A. D. 1908, the appearance of Mr. A. C. Fowler, as counsel for the appellee, was filed in said cause, in the words and figures following, to-wit:

(*Appearance of Mr. A. C. Fowler as Counsel for Appellee.*)

United States Circuit Court of Appeals, Eighth Circuit.

No. 2857.

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY,
Appellant,
vs.
WAGNER ELECTRIC AND MANUFACTURING CO.

734 The clerk will enter my appearance as Counsel for the Appellee.

A. C. FOWLER,
Pierce Bldg., St. Louis, Mo.

(Endorsed:) U. S. Circuit Court of Appeals, Eighth Circuit. No. 2857. Westinghouse Electric & Manufacturing Co., Appellant, vs. Wagner Electric and Manufacturing Co. Appearance. Filed Sep. 11, 1908, John D. Jordan, Clerk. A. C. Fowler, Counsel for Appellee.

And on the seventeenth day of December, A. D. 1908, the appearance of Mr. Chester H. Krum as counsel for the appellee was filed in said cause, in the words and figures following, to-wit:

(*Appearance of Mr. Chester H. Krum as Counsel for Appellee.*)

United States Circuit Court of Appeals, Eighth Circuit.

No. 2857.

WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., Appellant,
vs.
WAGNER ELECTRIC AND MANUFACTURING CO.

The Clerk will enter my appearance as Counsel for the Appellee.

CHESTER H. KRUM,
500 Roe Building.

(Endorsed:) U. S. Circuit Court of Appeals, Eighth Circuit. No. 2857. Westinghouse Electric and Manufacturing Co., Appellant, vs. Wagner Electric and Manufacturing Co. Appearance. Filed Dec. 17, 1908, John D. Jordan, Clerk. Chester H. Krum, Counsel for Appellee.

And on the sixth day of January, A. D. 1909, in the record of the proceedings of said Circuit Court of Appeals is an entry in said cause, in the words and figures following, to-wit:

(*Argument Commenced.*)

735 United States Circuit Court of Appeals, Eighth Circuit, December Term, 1908.

No. 2857.

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, Appellant,
vs.
WAGNER ELECTRIC AND MANUFACTURING COMPANY.

Appeal from the Circuit Court of the United States for the Eastern District of Missouri.

WEDNESDAY, *January* 6, 1909.

This cause having been called for hearing in its regular order, and Judge Adams being disqualified he retires and takes no part in the hearing or decision of this cause. Thereupon argument was commenced by Mr. Thomas B. Kerr in behalf of the appellant and continued by Mr. Paul Bakewell for the appellant and by Mr. A. C. Fowler for the appellee but the hour of adjournment having arrived before the conclusion thereof, the further hearing of this cause was postponed until tomorrow morning.

(*Order of Submission.*)

And on the seventh day of January, A. D. 1909, in the record of the proceedings of said Circuit Court of Appeals is an order of submission in said cause, in the words and figures following, to-wit:

United States Circuit Court of Appeals, Eighth Circuit, December Term, 1908.

No. 2857.

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, Appellant,
vs.
WAGNER ELECTRIC AND MANUFACTURING COMPANY.

Appeal from the Circuit Court of the United States for the Eastern District of Missouri.

THURSDAY, *January* 7, 1909.

This cause having been called this day for further hearing, argument was continued by Mr. A. C. Fowler and Mr. Chester H. Krum for the appellee and concluded by Mr. Paul Bakewell for the appellant.

Thereupon the cause was submitted to the Court, com-
736 posed of Judges Sanborn, Van Devanter and Riner, upon the transcript of record from said Circuit Court and the briefs of counsel filed herein.

(*Opinion.*)

And on the sixteenth day of August, A. D. 1909, the opinion of said United States Circuit Court of Appeals was filed in said cause, in the words and figures following, to-wit:

737 United States Circuit Court of Appeals, Eighth Circuit, May Term, A. D. 1909.

No. 2857.

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, Appellant,
vs.
WAGNER ELECTRIC AND MANUFACTURING COMPANY, Appellee.

Appeal from the Circuit Court of the United States for the Eastern District of Missouri.

Mr. Thomas B. Kerr and Mr. Paul Bakewell, (Mr. Drury W. Cooper and Bakewell & Cornwall with them on the brief), for appellant.

Mr. A. C. Fowler and Mr. Chester H. Krum, for appellee.

Before Sanborn and Van Devanter, Circuit Judges, and Riner, District Judge.

RINER, District Judge, delivered the opinion of the court.

This was a bill in equity filed by the appellant, Westinghouse Electric and Manufacturing Company, in the Circuit Court of the United States for the Eastern District of Missouri.

The bill charges the appellee, Wagner Electric and Manufacturing Company, with infringement of letters patent of the United States, No. 366,362, dated July 12, 1887, issued to George Westinghouse, Jr., and by him assigned to the appellant. The patent relates to improvements in electrical converters or transformers and the bill prayed for an injunction and an accounting.

The general nature and object of the invention is thus stated by the patentee: "The invention relates to the construction of a class of apparatus employed for transforming alternating or intermittent electric currents of any required character into currents differing therefrom in certain characteristics. Such apparatus are usually termed 'induction coils' or 'converters.' The object of this invention is to provide a simple and efficient converter which will not become overheated when employed for a long time in transforming currents of high electric-motive force, and which will be thoroughly ventilated."

738 The following drawings, copied from the patent, show a cross section and a longitudinal section of appellant's transformer.

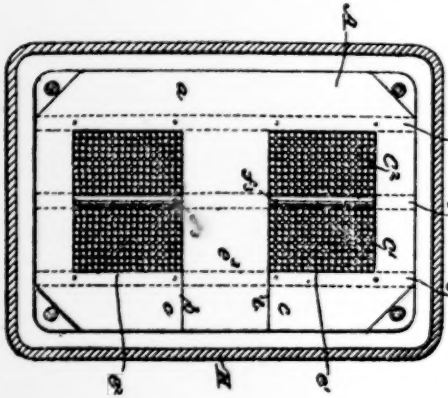


Fig. 1.

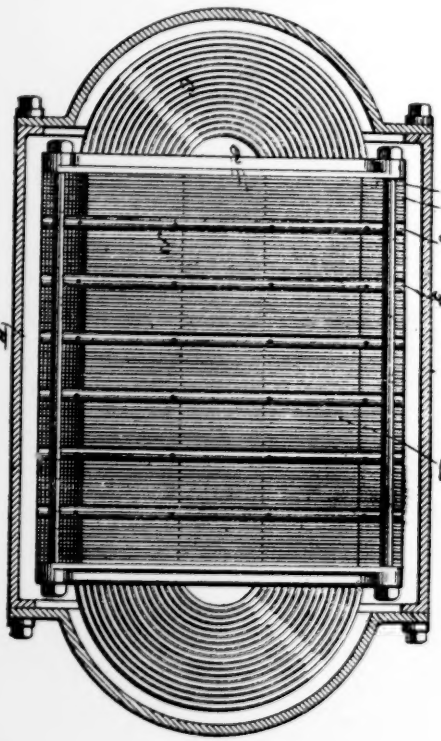


Fig. 2.

Having reference to the above drawings, the patentee, in describing the invention, says:

"Referring to the figures, A represents the core of the converter, and C^1 and C^2 the respective coils. The core is preferably composed of thin plates of soft iron *a a*, separated individually
739 or in pairs from each other by thin sheets of paper or other insulating material. This insulating material is preferably applied to one surface of the plates by being glued or pasted thereto, and these surfaces may lie all in the same direction, thus separating the plates individually, or alternate plates may have their covered surfaces in one direction and the intervening plates have their covered faces in the opposite direction, thus magnetically separating the plates in pairs.

"The plates are preferably constructed with two rectangular openings, e^1 and e^2, through which the wires pass. For convenience in inserting the coils, or rather in applying the plates to the coils after the latter have been wound, a cut is made from each opening, as shown at *b b*. By bending the ends *c c* upward the plates may then be thrust into position, and the ends *c c* then close about the coils. The tongues e^3 of succeeding plates are preferably inserted from opposite sides. I do not, however, herein broadly claim an induction-coil having its core constructed of thin plates formed in the manner just described; but such invention is claimed in an application of even date herewith, filed by Albert Schmid. Each group of—say five or six—plates thus applied is preferably separated from the succeeding group by air-spaces. These may be produced by passing tubes f^1 f^1, which may be of soft iron or other metal, or vulcanized fiber, along the lengths of the plates. It may be sufficient in other instances to block the group of plates apart at intervals instead of extending the tubes the entire length. Preferably also the primary and secondary coils C^1 C^2 are separated from each other in a similar manner. In this instance blocks or tubes f^2, of non-conducting materials are used. The tubes may be perforated, as shown at f^3 f^3. Where the converter is to be used in open air, the tubes f^1 and f^2 would permit a free circulation of air, and thus aid in keeping the converter cool.

"It may be preferred in some instances to surround the converter with some oil or paraffine or other suitable material, which will assist in preserving insulation and will not be injured by heating. This material when in a liquid form circulates through the tubes and the intervening spaces of the coils and plates, and preserves the insulation, excludes the moisture and cools the converter.

"The entire converter may be sealed into an inclosing case, H, which may or may not contain a non-conducting fluid or a gas."

The patent contains five claims, but the bill charges infringement of Claim Four only, which reads: "The combination, substantially as described, of an electric converter constructed with open spaces in its core, an inclosing-case, and a non-conducting fluid or gas in said case adapted to circulate through said spaces and about the converter."

This claim was adjudged valid in Westinghouse Electric & Mfg.

Co. v. Union Carbide Co. 112 Fed. 417, 117 Fed. 495, here-
740 after referred to as the Carbide case; Westinghouse Electric & Mfg. Co. v. American Transformer Co. 130 Fed. 550, and its validity was also recognized by the Circuit Court in this case.

In the foregoing cases it was decided that most, it nor all, of the elements of the combination of Claim Four were old in the art, but the combination being new it was held patentable, and in this view we concur. The appellee manufactured and sold two types of transformers, the device involved in the carbide suit, which was there held to be an infringement of Claim Four of appellant's patent, and the device referred to in the record as "Type M." Both are claimed by appellant to be infringements of Claim Four of its patent. The court below found that appellee's Type M. device did not infringe Claim Four of appellant's patent, and referred the cause to a master to take and state an account of the "profits, gains and advantages" received by the appelle, together with all damages suffered by the appellant by reason of the manufacture and sale by the appelle of the transformer held in the Carbide suit to be an infringement of Claim Four of the patent. Upon the incoming of the *the* master's report exceptions were filed thereto by the appellee, the exceptions sustained and a decree awarding appellant nominal damages only was entered.

Two questions are presented for decision. First: Did appellee's transformer, Type M., infringe Claim Four of appellant's patent? Second; what is the proper measure of recovery upon the accounting? These questions will be considered in the order stated.

The appellee's transformer, decided in the Carbide suit to be an infringement of the appellant's patent, had open spaces not only between the coils and between the coils and the core, but also open spaces in the core, and as to that device it is admitted in the answer that the decision in that case is res adjudicata and that a permanent injunction should be granted, but the answer denies that the other type of transforming involved in this suit, known as Type M. is an infringement of Claim Four of plaintiff's patent; and the appellee insists that, while its transformer, Type M., the only one manufactured by it since the decision in the Carbide suit, has open spaces between the coils and between the coils and the core, it has no open spaces in the core within the meaning of Claim Four of appellant's patent, and that the open spaces in the core are one of the principal elements of the combination of the claim in suit, therefore, its Type M device is not an infringement. Thus, the question is presented whether the open spaces between the coils and between the coils and the core, found in appellee's device, Type M, can be said to be open spaces in the core, within the meaning of Claim Four of appellant's patent. It is not contended that the rectangular openings in the core for the purpose of admitting the coils come within the claim, but it is insisted by appellant that the open spaces between the coils and between the coils and the core are open spaces in the core within the meaning of the claim we are now considering.

741 That claim is for a combination and the rule by which we are to be governed in the determination of the question

presented is clearly stated in Water Meter Co. v. Desper, 101 U. S. 322, as follows: "It is a well-known doctrine of patent law, that the claim of a combination is not infringed if any of the material parts of the combination are omitted. It is equally well known that if any one of the parts is only formally omitted, and is supplied by a mechanical equivalent, performing the same office and producing the same result, the patent is infringed."

And again, in the same case, the court said: "Our law requires the patentee to specify particularly what he claims to be new, and if he claims a combination of certain elements or parts, we cannot declare that any one of these elements is immaterial. The patentee makes them all material by the restricted form of his claim. We can only decide whether any part omitted by an alleged infringer is supplied by some other device or instrumentality which is its equivalent."

In Westinghouse Electric & Mfg. Co. v. American Transformer Co. supra, the Circuit Court for the District of New Jersey, in contrasting the several claims of the patent, one with another, for the purpose of more certainly ascertaining the meaning of Claim Four, said:

"* * * the 'spaces' of claim 4 are 'open spaces in its core.' The 'open space' of claim 1 is that intervening between 'parallel primary and secondary coils.' The combination of claim 2 has as its elements, first, primary and secondary coils, second, a core composed of lumina of soft iron arranged in groups and third, 'open, spaces' separating said groups. This claim, aside from the coils, specifically refers to the construction of the core, but lacks the elements of 'an inclosing case' and 'a non-conducting fluid or gas in said case adapted to circulate through said spaces and about the converter,' included in the combination of claim 4. The elements of the combination of claim 3 are, first, a core composed of soft iron plates arranged in groups and, second, 'open tubes,' intervening. This claim specifically refers to a particular construction of the core, but like claim 2, lacks two of the elements of claim 4. Claim 5 includes the following elements: first, primary and secondary coils, second, a core composed of magnetically separated laminæ of soft iron arranged in groups, third, 'air spaces' separating the different groups from each other and, fourth, the arrangement of the laminæ of the several groups in different parallel planes. This claim also specifically refers to a particular construction of the core, but, like claims 2 and 3, lacks the same two elements of claim 4. In the combination of claim 4 'open spaces in its core' as well as an 'inclosing-case' and 'a non-conducting fluid or gas' therein, are 'substantially as described.' No doctrine of equivalency can dispense with the open spaces in the core of the transformer, for they are a necessary element of the combination. Without them
742 the claim cannot be satisfied. Open spaces might be produced in the core other than those specifically set forth in the drawings or description, which would be the equivalent of the latter. The core itself might, for instance, be cut into in various directions in such manner as to expose what may be termed internal

heat-dissipating surfaces to the oil or other medium surrounding the transformer, and in such case, the other requirements of the combination being satisfied, infringement could be found. But the essence of the first element of the claim insisted on is that the open spaces of the transformer must be 'in its core.'"

And in passing upon this question in the present case, Judge Adams, then presiding in the Circuit Court, said:

"These numerous paralled open spaces so shown in the drawings and model, and any other open spaces, whether parallel or not, cutting through the body of the surrounding core and extending into the interior opening containing the coils, are, in my opinion, the 'open spaces in its core' contemplated by claim 4. The purpose of these open spaces, as disclosed by the patent and the evidence of experts, is to permit the oil to so bathe the heat-producing surfaces of the transformer, and to so circulate throughout the parts of the transformer, as to preserve the insulation of the coils, and radiate the heat generated by the transformer's action. The use of oil or parafline in a tank inclosing the transformer for the purposes just specified has been long known to the art, and is recognized by at least two patents prior in date to complainant's patent. Accordingly, the invention has for its main purpose only the physical means for effectually securing this circulation of oil. It deals with the core itself and divides it up into groups of plates, each group separate from the other in such way as to make numerous parallel open spaces in the core leading from its outer surface on all its four sides into the interior opening made for the introduction of the coils. This interior opening called in the patent 'two rectangular openings e^1 and e^2, through which the wires pass,' is not in my opinion, 'an open space in its core,' within the meaning of claim 4. I adopt the views of Prof. Nipher with respect to this rectangular opening. He says: 'The core is not the core of a transformer or converter until these rectangular openings are made through it.' He says further: 'These openings give character to the core.' 'It is not a core until they exist there.' 'The core is in fact given such a form that it surrounds the coil in a certain sense, and the space so surrounded by the core might be called a coil opening.' The core of a transformer is the iron part of it. It must be so constructed as to permit the introduction of the coils of wire approximately through its center. The wire coil must be put in to make a transformer. I cannot understand how this space left in the inside of the iron for this purpose can be an open space in the core. It might be as well said that the space left on the outside of the iron, between it and the incasing tank, is an open space in the core. The defend-
743 ant's device has a space between the coils, and has also this rectangular opening for the introduction of the coils into the core, but, for the reasons above expressed, these are not 'open spaces in its core' within the meaning of the patent in suit." 129 Fed. 604.

As already suggested, if we understand appellant's contention, it is that the term "open spaces in the core" in Claim Four of its patent, includes and means spaces between the coils and between the

coils and the core, or that such spaces are the equivalent of spaces in the core. But the trouble with this suggestion is that the claim in suit describes no such spaces, and by its particularization impliedly excludes them. In that claim the patentee describes a combination consisting of certain enumerated elements, and by that enumeration he is bound.

The Circuit Court held that the open spaces in the core, as described in Claim Four and the open spaces between the coils and between the coils and the core were physically different things; and that this is so is apparent, as we think, from an examination of the patent as a whole.

As we fully concur in the conclusion reached by the Circuit Court, that the appellee's device, Type M, does not infringe Claim Four of appellant's patent, we pass to the second question, namely, the measure of recovery upon the accounting for the admitted infringement which is predicated upon the type of transformer involved in the Carbide case.

At the conclusion of the appellant's case the appellee demurred to the evidence on the ground that under the showing then made, appellant was entitled to nominal damages only; the demurrer was overruled by the master; the appellee then introduced evidence, and the cause was submitted.

The master found that each and every part of Claim Four of appellant's patent was old, with the exception of the air-tight inclosing case; that the patentee made a wholly new combination described in Claim Four of his patent; that this new combination constituted an entirely new transformer complete in itself; that it was infringed in its entirety by appellee's transformer; that the entire commercial value of the infringing transformers manufactured and sold by the appellee during the time concerned in the accounting, was due to the presence therein of the combination described in Claim Four of appellant's patent; that the profits made by the appellee on the infringing transformers were merged in the profits of its general business so that it was impossible to separate them; that the appellee kept no separate account of the manufacture of the infringing transformers and did not know and could not furnish the cost of the manufacture of them, nor even an estimate of such cost; that the business of the manufacture and sale of the infringing transformers was so intermingled and confused with appellee's general
744 business, that approximate results only would be possible; that the profits realized by the appellee from the manufacture and sale of the infringing transformers, as nearly as it could be reached through "estimates, comparisons and apportionments," were approximately twenty-five per cent. on the net amount of sales of the infringing transformers; that the gross sales, after deducting commissions, amounted to $874,060.15; that the labor and material amounted to $529,733.43; that the factory cost amounted to $211,893.37; that the profits realized were $134,433.35, and he recommended that a decree be entered in favor of appellant and against the appellee for that amount.

Exceptions were filed to the findings and recommendation of the

master and upon final hearing the court disapproved the report of the master, sustained the exceptions to his findings and recommendation and in lieu of the decree recommended by the master entered one allowing appellant nominal damages only. The opinion, to which reference was made in the decree, discloses that the court was of opinion that the patented combination of the appellant was only a part of the infringing transformer manufactured and sold by the appellee; that the appellant was not entitled to the entire profits realized by the appellee from that transformer, but only to so much of the profits as was due to the presence in that transformer of the patented combination; that the burden was upon the appellant to show by competent evidence how much of the entire profits was due to the use of its combination; that the appellant had failed to sustain the burden so resting upon it and the evidence for the appellee threw no light upon the subject, and that the master's findings and recommendation proceeded upon the erroneous theory that, in that situation, the appellant could recover the entire profits realized by the appellee from the infringing transformer, regardless of what portion of those profits arose from the use of the appellant's patented combination.

We are unable to concur in the master's findings. We think Claim Four is a limited detailed claim—open spaces in the core being one of its chief or distinguishing features. This was the view entertained by Judge Amidon upon an application for a temporary injunction, and by Judge Adams at the hearing upon which the case was referred to the master. 129 Fed. 604. See also, Westinghouse Electric & Mfg. Co. v. Union Carbide Co., 117 Fed. 495; Westinghouse Electric & Mfg. Co. v. American Transformer Co., 121 Fed. 560, 130 Fed. 550.

The evidence clearly shows, we think, that the thing principally to be desired in the construction of a transformer is to keep the coils rather than the core from becoming over heated. The appellant's patent, Claim Four, seems to have proceeded upon the idea that the thing principally to be accomplished was to keep the core from becoming over heated and to that end it provided that one element of the combination covered by Claim Four was to be the open spaces in the core, nothing whatever being said in that claim about
745 open spaces between the coils or about open spaces between the core and the coils. Bearing in mind that the thing desired is to prevent the overheating of the coils, it will be seen that appellant's combination, Claim Four, operates to that end only in so far as the core if becoming overheated would have a tendency to heat the coils. The appellee in our view improved upon appellant's device by providing, in addition to spaces in the core, for spaces between the coils and spaces between the core and the coils, through which the oil or other cooling medium could circulate and thereby much more certainly and efficiently accomplish the purpose desired, viz: keeping the coils at a proper state of temperature. This, we think, was a material and substantial improvement on appellant's combination, Claim Four. It must, of course, be conceded that while appellant's combination, Claim Four, although really designed

to keep the core from becoming overheated, also tended to keep the coils from becoming overheated, but the appellees transformer much more efficiently accomplished the result desired by providing for a circulation of oil or other cooling medium through the open spaces between the coils and between the core and the coils, as well as through the open spaces in the core. We conclude, therefore, that the master was in error in finding that the entire commercial value of the infringing transformers manufactured and sold by the appellee during the time concerned in the accounting was due to the combination described in Claim Four of appellant's patent.

And to the extent that the appellee has improved upon that which was covered by appellant's patent, Claim Four, the appellant cannot demand the appellee's profits, because the only right of the appellant to complain of the appellee is in the use by the appellee of the patented combination, Claim Four, and the only right which the appellant has to profits realized by the appellee is confined to such profits as resulted solely from the use of appellant's combination, Claim Four, the profits resulting from the improvement made by the appellee being something in which the appellant has no interest. The evidence shows, we think, that the open spaces between the coils and between the core and the coils performed a very substantial office and that if added to spaces in the core would, as already suggested, necessarily accomplish the desired result more certainly and more efficiently.

The patented device covered by Claim Four, being, as we view it, a limited detailed claim and not being generally for a circulatory system throughout the heat producing parts of the transformer, and the appellee's infringing transformer embracing something of value not covered by that claim, viz: open spaces between the coils and between the coils and the core, we are of opinion that the appellant, whose patent covered only part of the infringing device, is not entitled to recover all the profits made by the appellee, but only such as resulted from the patented invention. Stirrat v. Excelsior Mfg. Co. 61 Fed. 980; Baker v. Crain, 130 Fed. 60; Robertson v. Blake, 94 U. S. 228; Garretson v. Clark, 111 U. S. 120.

746 The master's report shows that appellant offered no evidence upon the question of damages, but relied entirely upon the position that the amount which it was entitled to recover could be based upon the profits realized by the appellee from the sale of the infringing device.

The master found that the appellee kept no separate account of its profits realized from its infringing device, but on the contrary, that the profits made by appellee on the infringing transformers were merged with the profits of its entire business, so that it was impossible to separate them and that the appellee did not know and could not furnish the cost of the manufacture of the infringing transformers or even an estimate thereof. We do not think the mere failure to keep separate the profits derived from the infringing device under the circumstances disclosed by the record, warrants the application of the equity rule, that where one wrongfully

mingles his goods with those of another so that they are indistinguishable from the mass, the party injured is entitled to take the whole. This rule has been applied in cases of the invasion of a copyright where the wrongdoer has mingled in the book, matter to which a copyright does not properly extend with matter covered by the copyright, "the two necessarily going together, when the volume is sold as a unit, and it being impossible to separate the profits on the one from the profits on the other and the lawful matter being useless without the unlawful." Callaghan v. Myers, 128 U. S. 617.

There is no evidence tending to show that the appellant's failure to show how much of the appellee's profit resulted from the infringed combination and how much from the presence of the other elements of the infringing transformer, was due to any refractory or deceitful conduct on the part of the appellee, such as destruction or hiding of the books, or refusal to produce them for the use of the appellant. The mere failure on the part of the appellee to keep an account separating the profits prior to the sustaining of appellant's patent and at a time when, as the record shows, appellee believed in good faith that it was not invading any right of the appellant, is not conduct which would render the appellee liable as a confuser of goods within the rule just stated, nor such conduct as would relieve appellant from the necessity of carrying the prescribed burden of proof. Seymour, et al. v. McCormick, 57 U. S. 479.

In Keystone Mfg. Co. v. Adams, 151 U. S. 139, the Supreme Court, discussing a similar question, said: "While it is undoubtedly established law that complainants in patent cases may give evidence tending to show the profits realized by defendants from use of the patented devices, and thus enable the courts to assess the amounts which the complainants are entitled to recover, yet it is also true that great difficulty has always been found, in the adjudicated cases, in applying the rule that the profits of the de-
747 fendant afford a standard whereby to estimate the amount which the plaintiff is entitled to recover, and in defining the extent and limitations to which this rule is admittedly subject.

Such a measure of damages is of comparatively easy application where the entire machine used or sold is the result of the plaintiff's invention; but when, as in the present case, the patented invention is but one feature in a machine embracing other devices that contribute to the profits made by the defendant, serious difficulties arise.

It is unnecessary, in this opinion, to review the numerous cases, some at law, others in equity, wherein this court has considered various aspects of this question. It is sufficient to say that the conclusions reached may be briefly stated as follows: It is competent for a complainant, who has established the validity of his patent and proved an infringement, to demand, in equity, an account of the profits actually realized by the defendant from his use of the patented device; that the burden of proof is on the plaintiff; that where the infringed device was a portion only of defendant's machine, which embraced inventions covered by patents other than that for the infringement of which the suit was brought, in the absence of proof to show how much of that profit was due to such other

patents, and how much was a manufacturer's profit, the complainant is entitled to nominal damages only," citing Seymour v. McCormick, 16 How. 480; Rubber Co. v. Goodyear, 9 Wall. 788; Mowry v. Whitney, 14 Wall. 620; Elizabeth v. Pavement Co., 97 U. S. 126.

In Garretson v. Clark, 111 U. S. 120, the Supreme Court quoted with approval a statement of the rule announced by the Circuit Court, as follows: "The patentee must in every case give evidence tending to separate or apportion the defendant's profits and the patentee's damages between the patented feature and the unpatented features, and such evidence must be reliable and tangible, and not conjectural or speculative." And upon this question the burden of proof is upon the complainant. If he fails to carry this burden he is entitled only to nominal damages.

In Tilghman v. Proctor, 125 U. S. 136, the court, in the course of its opinion, said: "The infringer is liable for actual, not for possible, gains. The profits, therefore, which he must account for are not those which he might reasonably have made, but those which he did make, by the use of the plaintiff's invention; or, in other words, the fruits of the advantage which he derived from the use of that invention, over what he would have had in using other means then open to the public and adequate to enable him to obtain an equally beneficial result. If there was no such advantage in his use of the plaintiff's invention, there can be no decree for profits, and the plaintiff's only remedy is by an action at law for damages."

Here the appellant failed to prove by reliable or tangible evidence that the entire value of the infringing transformer as a
748 marketable article was properly and legally attributable to appellant's patented combination embodied therein, and so, in the light of the decisions above cited, and many others, which we have examined, announcing the same rule, we think that the appellant is entitled to recover nominal damages only; in other words, that as part only of the profits made by the appellee are attributable to the appellant's combination, the balance being attributable to the presence in the infringing device of elements not included in that combination, and as the appellant failed to make proof of how much of the total profits was due to the presence of its combination in the infringing device, there is nothing upon which more than a nominal recovery could be grounded.

The conclusion reached is that the decree finding that the device Type M, without open spaces in the core, now manufactured by the appellee, does not infringe appellant's patent and that the appellant is entitled to nominal damages only on account of the infringing device, must be affirmed.

Filed August 16, 1909.

SANBORN, *Circuit Judge*, dissenting:

A clear conception of the desideratum and of the root, principle, or mode of operation of an invention devised to attain it, is indispensable to a correct decision of a question of infringement because that device or combination is the mechanical equivalent of another under

the law of patents which accomplishes the desideratum in substantially the same way although the device differ in name, form, location or shape. Machine Company v. Murphy, 97 U. S. 120, 125; Winans v. Denmead, 15 How. 330, 342; Blandy v. Griffith, 3 Fisher's Patent Cases, 609, 616, 3 Fed. Cases No. 1529, pages 675, 678.

The claim of the invention involved in this case is: "The combination, substantially as described, of an electric converter constructed with open spaces in its core, an inclosing case, and a non-conducting fluid or gas in said case adapted to circulate through said spaces and about the converter."

The specification of a patent, which forms a part of the same application as its claim, must be read and construed with it to ascertain the true meaning and actual intent of the parties to the contract which the specification and the claim evidence, for the purpose of determining what the principle or mode of operation was which the parties intended to secure to the patentee. Seymour v. Osborne, 11 Wall. 516, 547; O. H. Jewell Filter Co. v. Jackson, 72 C. C. A. 304, 308, 140 Fed. 340, 344.

Prior to the invention under consideration it had been impracticable to use converters cooled by the natural circulation of
749 air which had a capacity of more than 10 kilowatts. But by the use of the patentee's combination, by means of which a circulation of oil through and around the converter in an inclosed case was effected, converters with a capacity of 500 kilowatts became serviceable and merchantable. The following terms of the specification show the object and the principle or mode of operation of the invention. "The object of this invention is to provide a simple and efficient converter which will not become overheated when employed for a long time in transforming currents of high electromotive force. * * * The core is preferably composed of thin plates of soft iron *a a*. * * * The plates are preferably constructed with two rectangular openings, e^1 and e^2, through which the wires pass. * * * Each group of—say five or six—plates thus applied is preferably separated from the succeeding group by air spaces. These may be produced by passing tubes f^1 f^1, which may be of soft iron or other metal, or of vulcanized fiber, along the lengths of the plates. It may be sufficient in other instances to block the groups of plates apart at intervals instead of extending the tubes the entire length." * * *

"Preferably also the primary and secondary coils C^1 C^2 are separated from each other in a similar manner." * * *

"It may be preferred in some instances to surround the converter with some oil or paraffine or other suitable material, which will assist in preserving insulation and will not be injured by heating. This material when in a liquid form circulates through the tubes and the intervening spaces of the coils and plates and preserves the insulation, excludes the moisture and cools the converter. The entire converter may be sealed into an enclosing case."

The claim under consideration is restricted to the invention of the combination, substantially as described in this specification, of an electric converter with open spaces in its core, an inclosing case and

a non-conducting fluid or gas in the case adapted to circulate through the spaces in and about the converter.

What was the object of this invention? The prevention of the overheating of the converter and of every part of it. What was the root, the principle, or mode of operation whereby this object was to be attained? The circulation of oil in a sealed case over increased radiating surfaces "through the tubes and the intervening spaces of the coils and plates" whereby the converter is cooled, insulation is preserved and moisture is excluded. In my opinion the principle of the invention patented under claim four is not either the rectangular openings across the planes of the iron plates, nor the tubes between the plates, nor the blocked spaces between them, nor the openings between the coils, nor any of the elements of the combination, all of which are described in the specification as preferably employed, but it is the circulation of the oil over increased radiating surfaces by means of the combination patented through open spaces in and about the converter, and what Westinghouse secured by this claim was not the particular openings he specified as preferably made in the core or in the converter, but, as held by the Circuit Court of Appeals of the Second Circuit in the decision upon which this and other suits for the infringement of this patent rest, "the means by which the external and internal surface of the heat-producing parts of a converter were cooled by such an arrangement and separation of parts as would permit the circulation about them of oil, and the means for the retention of said oil within and about said surfaces whereby the heat from the oil radiated to the surrounding air." Westinghouse Electric & Mfg. Co. v. Union Carbide Co., 117 Fed. 495, 498.

The defendant first made and sold a converter with open rectangular spaces in the soft iron plates in which the coils were inserted, with open spaces between the plates and with open spaces between the coils, and it was adjudged an infringement. It then made and sold a converter called type "M" with all the open spaces specified by the patentee except those between the plates and with spaces between the coils and the plates and it seeks to escape infringement because it has secured the requisite increased radiating surface for substituting the open spaces between the plates and the coils for the open spaces between the plates described by Westinghouse while it retains all the other open spaces and details of his description. But the substance of this invention is the circulation of oil around and through increased radiating surfaces in a converter inclosed in a sealed case and the locality in which the increased surfaces are placed and the forms in which they are embodied are immaterial upon the question of infringement because the principle or mode of operation is the same whether the surfaces are exposed by openings between the iron plates through which the oil circulates to and along the coils from without or by openings between the iron plates and the coils through which the oil may pass. In either case the object of the invention is attained by the circulation of the oil over the increased radiating surfaces of a converter in a sealed case.

It is contended that the spaces between the coils and the plates

are more efficient in cooling the coils which are more likely to become overheated than the plates. But in my opinion the evidence fails to sustain this contention and if it were sustained the defendant could not escape infringement by appropriating and then improving the patented combination of the complainant. The spaces between the coils and the plates are the plain mechanical equivalents of the spaces between the plates, because they do the same work in the same way, they cool the converter by the circulation of the oil through them and over increased radiating surfaces in a closed case and "if two devices do the same work in substantially the same way and accomplish the same result they are the same even though they differ in name, form or shape." Machine Company v. Murphy, 97 U. S. 120, 125. "Where the whole
751 substance of the invention may be copied in a different form, it is the duty of courts and juries to look through the form to the substance of the invention for that which entitled the inventor to his patent and which the patent was designed to secure. When that is found there is an infringement and it is not a defense that it is embodied in a form not described and in terms claimed by the patentee." Winans v. Denmead, 15 How. 330, 342. Because the open spaces between the coils and the plates which the defendant substituted for the open spaces between the plates were the mechanical equivalents of the latter and because the defendant's type "M" was a copy of the whole substance of the complainant's invention that converter seems to me to constitute an infringement of the fourth claim of the Westinghouse patent.

Moreover, the limitation of the words "open spaces in the core" in this fourth claim to the open spaces between the plates of the core seems to me to be unwarranted by the claim and specification (1) because the spaces between the plates are the subject of a specific claim, number two in this patent, and therefore these spaces are presumably not covered by the general claim of the combination which is here in suit, and (2) because the specification describes three other classes of open spaces in the core, to-wit: "two rectangular openings e^1 and e^2, through which the wires pass," "tubes f^1 f^1, which may be of soft iron or other metal, or of vulcanized fiber, along the lengths of the plates," and the spaces between the coils which "are separated from each other in a similar manner" that is to say, by tubes or blocks between them.

Not only this, but the open spaces between the plates are not claimed to be and are not an essential element of the combination of the fourth claim, but are expressly stated in the specification to be a mere preferable method of constructing the converter so as to give it increased radiating surface. On this subject the specification reads: "Each group of—say five or six—plates thus applied is preferably separated from the succeeding group by air spaces. These may be produced by tubes f^1 f^1. * * * It may be sufficient in other instances to block the group of plates apart at intervals instead of extending the tubes the entire length." The statute requires that the inventor shall point out the principle of his invention "and the best mode in which he has contemplated apply-

ing that principle, so as to distinguish it from other inventions; and he shall particularly point out and distinctly claim the part, improvement, or combination which he claims as his invention or discovery." U. S. Compiled Stat. §4888. A patent for a combination claimed secures the association of the elements specified, but does not claim or patent any of the elements or details of the specification. They are but a part of the preferable method pointed out, and one who takes and uses the principle and the whole substance of an invention as the defendant has in its type "M." may
752 not escape infringement by the mere substitution of other obviously equivalent means or details for some of the means described by the patentee as a part of his preferable mode of applying his principle. Paper Bag Patent Case, 210 U. S. 405, 418; Deering v. Harvester Works, 155 U. S. 286, 302; City of Boston v. Allen, 91 Fed. 248, 249, 33 C. C. A. 485, 486; Reece Button Hole Ma. Co. v. Globe Button Hole Ma. Co., 61 Fed. 958, 964, 10 C. C. A. 194, 200; Brammer v. Schroeder, 106 Fed. 918, 928, 930.

Turning to the question of damages for the infringement by the manufacture and sale of defendant's first converter we are met by the claims that the complainant was entitled to no recovery because the defendant improved the patentee's combination by adding open spaces between the plates and the coils and no evidence was produced which separated the profits attributable to that improvement from those derived from the patented combination and because the defendant did not stand in the relation of a trustee of the profits for the patentee and owed it no duty to keep them separate or to account for them. There is some testimony in the record that the coils became more overheated than the plates and that the open spaces between the coils and the plates tend to cool the former more efficiently than the spaces between the plates. But the spaces between the plates permit the oil to circulate between the plates against and around the oils and the evidence of the superiority of the spaces between the coils and the plates fails to persuade my mind that the latter constituted any real improvement upon the mode described by the patentee. On the other hand it leads me to believe that these new spaces and this theory concerning them constituted a mere subterfuge of the defendant conceived to avoid a just liability for its infringment.

Moreover, the measure of the complainant's damages was not the difference between the profits the defendant would have derived from the complainant's combination and those it did derive from its form of it. It was the difference between the profits which the defendant derived from the use of the complainant's combination and those it might have derived from the use of any other combination then known and open to the public which would have produced an equally beneficial result. Tilghman v. Proctor, 125 U. S. 136, 146, and as there was no such combination or converter the alleged improvement was immaterial.

The indisputable facts that converters that have a capacity between 10 kilowatts and 500 kilowatts were first made serviceable and merchantable by the complainant's combination and that all

the converters made and sold by the defendant were of this capacity and embodied the complainant's combination lie conceded at the foundation of this case. Without the complainant's combination whereby the oil was circulated in a sealed case through the intervening spaces of the coils and plates and around the converter the defendant never could have used or sold one of its infringing
753 transformers. In the light of these facts the master found that the entire commercial value of the infringing converters manufactured and sold by the defendant during the time concerned in the accounting was due to the complainant's combination. "The conclusions of the master, depending upon the weighing of conflicting testimony, have every reasonable presumption in their favor and are not to be set aside or modified unless there clearly appears to have been error or mistake on his part." Tilghman v. Proctor, 125 U. S. 136, 150; Medsker v. Bonebrake, 108 U. S. 66. And the evidence not only fails to disclose to my mind any error or mistake in the findings of the master, but compels my assent to his conclusion.

Is the complainant barred from the recovery of any of the profits the defendant derived from its infringement because it failed to separate those derived from its combination from those which the defendant otherwise derived from the infringement?

It is a settled rule that "Upon a bill in equity by the owner against infringers of a patent, the plaintiff is entitled to recover the amount of gains and profits that the defendants have made by the use of his invention. * * * The reasons that have led to the adoption of this rule are, that it comes nearer than any other to doing complete justice between the parties; that in equity profits made by the infringer belong to the patentee and not to the infringer, and that it is inconsistent with the ordinary principles and practice of courts of chancery, either, on the one hand, to permit the wrongdoer to profit by his own wrong, or, on the other hand, to make no allowance for the cost and expense of conducting his business, or to undertake to punish him by obliging him to pay more than a fair compensation to the person wronged. The infringer is liable for actual, not for possible, gains. The profits therefore which he must account for are not those which he might reasonably have made, but those which he did make, by the use of the plaintiff's invention; or, in other words, the fruits of the advantage which he derived from the use of that invention over what he would have had in using other means then open to the public and adequate to enable him to obtain an equally beneficial result. * * * A court of equity which has acquired, upon some equitable ground, jurisdiction of a suit for the infringement of a patent, will not send the plaintiff to a court of law to recover damages, but will itself administer full relief by awarding, as a substitute for legal damages, a compensation computed and measured by the same rule that courts of equity apply to the case of a trustee who has wrongfully used the trust property to his own advantage. Root v. Railway Company, 105 U. S. 189, 214, 215." Tilghman v. Proctor, 125 U. S. 136, 144, 145, 146, 148. Let us apply these rules to this case. The complainant

is entitled to the fruits of the advantage which the defendant derived over what it would have had in using any other known
754 converter then open to the public and adequate to enable it to obtain an equally beneficial result. There was no other known converter open to the public which could be used to produce the result obtained by complainant's combination. The complainant was consequently entitled to all the profits and all the advantages derived from the defendant's use of the infringing machine. Crosby Steam Gauge Valve Company v. Consolidated Safety Valve Company, 141 U. S. 441, 448, 449; Manufacturing Company v. Cowing, 105 U. S. 253.

The decisions present two classes of cases each governed by its own measure of profits recoverable for an infringement. Where the patented device is a slight improvement upon an existing and operative machine which accomplished the same result without as with the patented improvement, as in Garretson v. Clark, 111 U. S. 120; where the patented improvement was a slight change in the jaw of a well known and operative mop-head, Keystone Mfg. Co. v. Adams, 151 U. S. 139; where the improvement patented was a revolving winged shaft attached to an old operative and successful corn-sheller to facilitate the movement of the corn into the sheller, and in Seymour v. McCormick, 16 How. 480, where the improvement was a driver's seat upon an operative and successful harvesting machine, the profits from the sale or use of the entire machine, the entire mop-head, the entire corn-sheller, or the entire harvesting machine, may not be recovered by the patentee, but his recovery is limited to the profits derived from the patented improvement to the operative machine only. And when a complainant has a patent upon improvements to a machine parts of which are patented to others under prior grants, as in Blake v. Robertson, 94 U. S. 728, the recovery is likewise limited to the profits derived from the complainant's patented improvement separated from those derived from the improvements patented to others.

But where the complainant's patent secures a new combination or a new machine which accomplishes a result never attained before it was invented, the entire profits derived from the infringing device are recoverable, for, since no combination or device existed before the invention by which the desired object could be attained, there is no combination or device but the inventor's to which the profits can be lawfully attributed. Crosby Steam Valve Company v. Safety Valve Company, 141 U. S., 441, 448, 449, 454; Brennan & Company v. Dowagiac Mfg. Co., 162 Fed. 472, 475, 89 C. C. A. 392, 395; Dowagiac Mfg. Co. v. Superior Drill Company, 162 Fed. 479, 481; Elizabeth v. Pavement Company, 97 U. S. 126; Manufacturing Company v. Cowing, 105 U. S. 253; Hurlbut v. Schillinger, 130 U. S. 456; Warren v. Keep, 155 U. S. 265; Ruggles v. Eddy, 20 Fed. Cases, No. 12, 116; Zane v. Peck, 13 Fed. 475; Fifield v. Whittemore, 33 Fed. 835; Creamer v. Bowers, 35 Fed. 206; Orr & Lockett Hdwe. Co. v. Murray, 163 Fed. 54, 56. I am unable to escape the conviction that the case in hand falls under the

latter rule. The claim upon which this suit is founded is for
755 a patented combination of old elements. It is not restricted to the open spaces between the plates or to the inclosing case, or to anything but the association of all the elements described and claimed. Neither the open spaces between the plates, nor the tubes, nor the plates, nor the coils, nor the oil, nor the spaces between the coils, nor any other detail of the combination is patented by this fourth claim of the patent. Any one may use without infringing this claim not only these details, but also any one or all but one of the essential elements of the combination. The thing patented is one, single and entire. It is the combination of all the essential elements into the entire new converter which the combination produces. No one can infringe this claim of the patent who does not appropriate this entire new combination and this machine which that combination produces. And as this new combination and the converter it produces accomplished a result never attained before, a result that no known device or combination open to the public while the infringment here in controversy was continuing, would produce, this case is not governed by the rule applicable to slight improvements on old machines which accomplish the same result before as after the patented improvement illustrated by Garretson v. Clark, 111 U. S. 120, and other cases of that class, but the complainant is entitled to all the profits which the infringer derived from the appropriation of the new combination and machine. Brennan & Company v. Dowagiac Mfg. Company, 162 Fed. 472, 475; Yesbera v. Hardesty Mfg. Co., 166 Fed. 120, 125, and cases of that class cited above.

It appears to me therefore that the complainant was the owner of all the profits which the defendant derived from the manufacture and sale of the infringing converter and that the defendant was in equity a trustee of those profits for the complainant. The Supreme Court declares that it is the established rule of the nation that in a case of this nature a court of equity will administer full relief by awarding "a compensation computed and measured by the same rule that courts of equity apply to the case of a trustee who has wrongfully used the trust property to his own advantage." Tilghman v. Proctor, 125 U. S. 136, 148. What is that rule? Chancellor Kent stated it in Hart v. Ten Eyck, 2 Johnson's Chancery Reports (N. Y.) 62, 108, in these words: "The rule of law and equity is strict and severe on such occasions. If a party having charge of the property of others, so confuse it with his own, that the line of distinction cannot be traced, all the inconvenience of the confusion is thrown upon the party who produces it, and it is for him to distinguish his own property or lose it." The Supreme Court approved this statement of the rule in "The Idaho," 93 U. S. 575, 576.

The primary duty of a trustee is to keep the property of his cestui que trust separate from his own, to keep an account of it and to deliver it to the cestui qui trust. This infringer kept no account of these profits but mingled them with the profits of its general
756 business so that it was impossible for it or for any one to accurately separate them. But the record contains persua-

sive evidence of the entire amount which the defendant received from the sale of the infringing converters and that it customarily added to the cost of manufacture and sale a profit of 25% to make up its selling price. There is also persuasive evidence of the total amount received by the defendant from all its business during its infringing years and of the total profits derived from its business during these years. These are ample facts upon which to base a just and equitable finding of the amount of profits which the defendant derived from the sale of these infringing machines. The master has made a finding after a careful consideration of all the evidence upon the subject and that finding is presumptively right. The indisputable facts that for years the defendant continued to infringe until it had made and sold infringing machines from which it realized more than $800,000.00, are sufficient to satisfy the mind that its appropriation of the complainant's combination was profitable and when to this is added the evidence that 25% of the cost was ordinarily added by it to make its selling price it seems to me to be inequitable to permit the defendant to keep this property of the complainant because it mingled it with its own and thus allow it to take advantage of its own wrong. Of such a defense Lord Chancellor Brougham said in Docker v. Somes, 2 Myl. & Keene, 674:

"When did a court of justice, whether administered according to the rules of equity or law, ever listen to a wrongdoer's argument to stay the arm of justice grounded on the steps he himself had successfully taken to prevent his iniquity from being traced? Rather, let me ask, when did any wrongdoer ever yet possess the hardihood to plead in aid of his escape from justice the extreme difficulties he had contrived to throw in the way of pursuit and detection, saying: 'You had better not make the attempt, for you will find I have made the search very troublesome?' The answer is, 'The court will try.'"

The defendant cites again the cases of Garreston v. Clark, 111 U. S. 120; Seymour v. McCormick, 57 U. S. 479, and Keystone Mfg. Co. v. Adams, 151 U. S. 139, in defense of its course, but they are inapplicable because in such cases of slight improvements on operative machines it is often impossible for the infringer to know the portion of the profit attributable to the improvement and hence its duty to keep that part separate is not so imperative. But where, as in the case in hand, the complainant is entitled to the entire profits from the infringing devices of the defendant the duty is imperative and the failure to discharge it or the failure to distinguish subsequently such profits from its own, subjects, and ought to subject, the infringer and not its victim to any unavoidable loss that results from the inaccuracy either of the defendant's disclosure of its profits or of the complainant's proof when there is any substantial evidence upon which to base an estimate of the profits derived from the infringing devices.

757

In like cases upon evidence similar, but far less accurate and convincing than that in this record, infringers have been refused permission to take advantage of their own wrong and have been re-

quired to pay the estimated profits they derived from the infringing devices by the Circuit Court of Appeals of the Sixth Circuit in Brennan & Company v. Dowagiac Mfg. Company, 89 C. C. A. 392, 396, 162 Fed. 472, 476; Dowagiac Mfg. Company v. Superior Drill Company, 89 C. C. A. 399, 400, 162 Fed. 479, 480, and P. P. Mast & Company v. Superior Drill Company, 164 Fed. 45, 57, and by the Circuit Court of Appeals in the Second Circuit in Wales v. Waterbury Mfg. Co., 101 Fed. 126, 130, 41 C. C. A. 250, 253, 254, and I am of the opinion that this court ought to pursue the same course in the case before us.

For the reasons which have been stated I am unable to concur in the view of the majority that the decree of the court below should be affirmed, and I think it should be reversed and a decree should be rendered for the complainant.

Filed August 16, 1909.

758 And on the sixteenth day of August, A. D. 1909, in the record of the proceedings of said Circuit Court of Appeals is a decree in said cause, in the words and figures following, to-wit:

(*Decree.*)

United States Circuit Court of Appeals, Eighth Circuit, May Term, 1909.

No. 2857.

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, Appellant,

vs.

WAGNER ELECTRIC AND MANUFACTURING COMPANY.

Appeal from the Circuit Court of the United States for the Eastern District of Missouri.

MONDAY, *August* 16, 1909.

This cause came on to be heard on the transcript of the record from the Circuit Court of the United States for the Eastern District of Missouri, and was argued by counsel.

On Consideration Whereof, it is now here ordered, adjudged and decreed by this Court, that the decree of the said Circuit Court, in this cause, be, and the same is hereby, affirmed with costs; and that the Wagner Electric and Manufacturing Company have and recover against the Westinghouse Electric and Manufacturing Company the sum of twenty dollars for its costs herein and have execution therefor.

August 16, 1909.

And on the twenty-ninth day of September, A. D. 1909, a petition by appellant for a rehearing was filed in said cause, in the words and figures following, to-wit:

(Petition of Appellant for a Rehearing.)

759 United States Circuit Court of Appeals, Eighth Circuit, May Term, A. D. 1909.

No. 2857.

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, Appellant,
vs.
WAGNER ELECTRIC AND MANUFACTURING COMPANY, Appellee.

Appeal from the Circuit Court of the United States for the Eastern District of Missouri.

Petition of Westinghouse Electric and Manufacturing Company, Appellant and Complainant, for a Rehearing with Respect to the Majority Opinion of this Court, Filed August 16, 1909.

Now comes Westinghouse Electric and Manufacturing Company, appellant in this court and complainant in the court below, and respectfully petitions this court to grant a rehearing in respect to the majority opinion of this court filed on August 16, 1909, for the following reasons, which are amplified and more particularly pointed out in the body of this petition:

1. The majority of the court is in error in respect to the nature and scope of the invention of claim 4 of patent in suit, in that it did not give sufficient force and effect to "the matters and things found and decreed in the suit against the Union Carbide Company," which, in legal effect, as admitted in the answer of the defendant herein, are res adjudicata against the defendant, viz:

760 The Circuit Court of Appeals in the Carbide case (117 Fed., page 498) found that on the question of novelty and scope of the invention Westinghouse was "entitled to claim the means by which the external and internal surfaces of the heat-producing parts of a converter were cooled by such an arrangement and separation of parts as would permit the circulation about them, of oil, and the means for the retention of said oil within and about said surfaces, whereby the heat from the oil radiated to the surrounding air;" that if there was "any doubt upon the question of patentability, the practical and commercial results of this improvement must resolve such doubt in its favor; and the practical result was to increase the capacity of converters from 10 kilowatts up to 500 kilowatts." The legal effect of these findings was to classify the invention as a primary improvement, or as at least one marking a signal advance in the art and entitled to a liberal application of the doctrine of mechanical equivalents (Hollow Brake Beam Case, 106 F. 712, Paper Bag Case, 210 U. S. 415).

The findings in the Carbide case being res adjudicata, petitioner is entitled to their legal effect, and the majority of the court erred in not giving effect to these principles and in holding that defend-

ant was entitled to use a mechanical equivalent which accomplished the same result in the same way.

2. The invention being for a primary improvement, one marking a signal advance in the art and entitled to a liberal application of the doctrine of mechanical equivalents, and the claim in suit (4) being susceptible of an interpretation commensurate with its achievement in the art, the majority of the court erred in preferring a construction "which strikes down and paralyses" to one "which sustains and vitalizes the grant." (Hollow Brake Beam case, 106 F. 715-716).

3. The majority of the court erred in holding that the words "in its core" in claim 2 in suit, limited the patentee of open spaces in the substance of the core itself and excluded him from holding any other construction as a mechanical equivalent, practically destroying petitioner's right to the doctrine of mechanical equivalents. This is in direct contravention to the finding in Winans v. Denmead (15 Howard 342), and in Loom Company v. Higgins (105 U. S. 580), and of this Court in Hollow Brake Beam Case (106 Fed. 710-716), in Denning Wire Fence Case (169 Fed. 793), and in Wayne Co. v. Benbow Company (168 Fed. 271), in each of which cases the equivalent and infringing device differed
761 from the patented one in not containing the structural feature specified in the claim.

4. That the majority opinion of this court, in regard to the accounting feature of this case, is in error in holding that your petitioner failed to prove by reliable or tangible evidence that the entire value of the infringing transformer is properly and legally attributable to the complainant's patented combination embodied therein, in view of the things found and decreed in the Carbide case in relation to the nature of this invention, its history and the place it filled in the art, and of the fact that in each and all of the infringing transformers accounted for before the Master the defendant had embodied the invention the subject-matter of claim 4, which invention is thus defined by the Circuit Court of Appeals in the Carbide case, page 498 of 117 Fed.:

"In these circumstances the patentee seems to be entitled to claim the means by which the external and internal surfaces of the heat-producing parts of a converter were cooled by such an arrangement and separation of parts as would permit the circulation about them of oil and the means for the retention of said oil within and about said surfaces, whereby the heat from the oil radiated to the surrounding air."

The findings in the Carbide case are among the premises on which your petitioner could rely and did rely on the accounting, plus the fact that the defendant had recognized the value of this invention by adopting it in every one of the several thousand infringing transformers accounted for.

5. That the majority opinion of the court erred in its finding "that as part only of the profits made by the appellee are attributable to the appellant's combination, the balance being attributable to the presence in the infringing device of elements not included in that

combination, and as the appellant failed to make proof of how much of the total profits was due to the presence of its combination in the infringing device, there is nothing upon which more than a nominal recovery could be grounded." This finding is based on at least one mistake of fact in respect to mere formal differences between the invention described in the Westinghouse patent in suit and claimed by claim 4 thereof, and that is that in the majority opinion of the court it seems to assume that it is departure, even from the exact transformer illustrated in the Westinghouse patent, to have spaces between the coils, whereas, as a matter of fact, the patent in suit specifically refers at line 65, etc., to spaces between the coils, thus leaving the only difference—a mere formal one—between the infringing transformers and the structure described
762 in the patent and claimed by claim 4 thereof in that we have the ipse dixit of one of complainant's witnesses, unsupported by an actual original exhibit of any one of the infringing transformers accounted for, that the infringing transformers accounted for before the Master, in addition to having open spaces in the core, also had open spaces between the coils and the core, which, at best, is a mere extension in degree of the invention the subject-matter of claim 4, and but one form of embodiment of the invention of that claim 4 as the invention of that claim is defined by the Court of Appeals in the Carbide case at page 498 of 117 Fed. But even granting that the modified form of the transformer of the Westinghouse patent, exhibited in the defendant's infringing transformers, did involve a change or betterment in that it had, in a pronounced form, open spaces between the coils and the core, the profits due to such a change, in the sale of the infringing transformers, could not possibly be estimated; but, furthermore, if they could be estimated, under the decision of the Supreme Court in Elizabeth v. Pavement Co., 97 U. S. 141, the burden of proof in respect to any profits due to the presence of that alleged improved form was not on your petitioner but on the defendant. The majority opinion is also in conflict with decision of U. S. Supreme Court in Valve Co. v. Crosby, 141 U. S. 441.

In the respects above alluded to, on the accounting feature of this case, and which are numbered 4 and 5, we have undertaken to point out in detail between pages 35 and 64 of this petition for rehearing wherein this court erred in its premises and in its conclusions, and that, under the facts in this case, the opinion of the majority of this court is in conflict with what we conceive to be leading and controlling decisions of the Supreme Court of the United States, rendered in analogous cases, as well as in conflict with recent decisions of the United States Circuit Court of Appeals in other circuits, and out of harmony with the principals underlying leading decisions in this very Court of Appeals. In justice to the majority opinion of this court and to ourselves, it is impossible for us to point out the errors which we firmly believe the majority of this court made in its opinion both in regard to matters of fact and propositions of law, without showing in detail how we believe those errors crept into the opinion of the majority of this court, resulting in mistaken premises and

consequently in erroneous conclusions; and this we attempt to do in the following pages:

As To "Type M" Transformer.

We most respectfully submit that, on this record and in view of the things found and decreed in the Carbide case (112 Fed. 763 417, and 117 Fed. 495), by which matters this defendant, which defended the Carbide case by its own counsel, is legally and also admittedly bound (see Bill, Record 3-5 and Answer, Record 11-13, especially paragraph VIII of Answer), too little weight seems to have been given to the force and effect of the things found and decreed in said Carbide case, which matters and things, as the answer here expressly admits, are "res adjudicata against this defendant," and which matters and things, under the decisions of this court and of the Supreme Court of the United States in analogous cases, must most materially affect the question of the scope to be given to claim 4 of the Westinghouse patent in suit, and consequently the range of equivalents which are within the ambit of that claim.

On the other hand, we most respectfully submit that the opinion of the court below, with respect to the proper construction of claim 4, and in the part thereof quoted in the opinion of the majority of this court, is materially erroneous, not only in respect to its premises but also in respect to its conclusions. We also believe that too much weight has been given by the majority opinion of this court to the opinion in the case of Westinghouse Company v. American Transformer Company, reported in 130 Fed. 550, the latter opinion having practically followed the decision of the Circuit Court in this case, and being erroneous, as we believe, as it is founded on very much the same errors of law and fact which are found in the opinion of Judge Adams in the court below.

Furthermore, in the said case decided by Judge Bradford, of Westinghouse v. American Transformer Company, 130 Fed. 550, the estoppel which arises on this record in respect to the matters and things found and decreed in the Carbide case was not applicable as against the defendant in that case.

It must be remembered, as the Record in this case shows, as the Bill alleges, and as the Answer admits, that the question of the nature and scope of the invention of the patent in suit was at issue in the Carbide case; that the Carbide Company was simply a user of a transformer made by the Wagner Electric & Manufacturing Company, the defendant in the case at bar; and that this defendant, the Wagner Electric & Manufacturing Company, had its day in Court in respect to the question of the scope and validity of claim 4 of the patent in suit in the said suit against the Carbide Company, having defended the same at its own expense and by its own counsel. By this we do not mean to say that in the case at bar the Wag- 764 ner Company could not dispute as to whether or not type M transformer infringed claim 4 of the patent in suit; but we do mean to say that such dispute could hardly be more than a formal one, in the light of the record in this case and of the fact that, with

the same prior art before it that was presented to the Circuit Court in the case at bar, the Circuit Court and Court of Appeals in the Carbide case had made such findings as to the scope and nature of the invention the subject-matter of claim 4 of the patent in suit (by which findings this defendant was bound) that defendant's type M transformer comes clearly within the ambit of the invention of claim 4 as defined by the court in the Carbide case.

It must be borne in mind that the patent in suit, granted for an invention antecedently made, was issued as early as July 12, 1887. No one has recognized more clearly than has Judge Adams himself the fact that in determining the question of whether or not an invention has been made, and also as to its nature and scope, we should look at the invention not from the possibly advanced condition of the art at the date of litigation in respect to the patented invention, but in respect to the conditions as they existed in the art at the time the invention was made. See opinion of Judge Adams in the case of McConway & Torley Co. v. Shickle, Harrison & Howard Iron Co., 92 Fed. 162, and what he says in regard to the question above referred to, from the foot of page 165 to and including page 166 of 92 Fed. It is also interesting to note that the claim of the Janney patent there in suit, recited at page 163 of 92 Fed., was for a simple combination in the form of an improved car coupler which, gauged by the results achieved, was recognized as a most valuable invention and sustained, although the difference between the car coupler of the Janney patent there involved and the car coupler of the prior art were comparatively slight. It is also significant that in that case Judge Adams quotes with approval cases upon which we now rely. We here quote from the opinion of Judge Adams in the last named case as the same is found at page 166 and 167 of 92 Fed.:

"The language of Mr. Justice Bradley in the case of Lom Co. v. Higgins, 105 U. S. 580, seems to be pertinent to this case. He says as follows:

'But it is plain from the evidence, and from the very fact that it was not sooner adopted and used, that it did not for years occur in this light even to the most skillful persons. It may have been under their very eyes; they may almost be said to have stumbled over it;
but they certainly failed to see it, to estimate its value, and
765 to bring it into notice. * * * Now that it has succeeded, it may seem very plain to any one that he could have done it as well. This is often the case with inventions of the greatest merit. It may be laid down as a general rule, though perhaps not an invariable one, that if a new combination and arrangement of known elements produce a new and beneficial result, never attained before, it is evidence of invention.'

"On the same subject, Mr. Justice Blatchford, then circuit judge, said in the case of Wooster v. Blake, 8 Fed. 129, as follows:

'Much is said in the evidence on the part of the defendants as to the obvious character of this or that arrangement, and that any mechanic would know enough to do this or that. This is the oft-repeated story in belittling inventions. The invention consists

primarily in finding out what mechanical operation is necessary to produce the practical result arrived at. When such operation is hit upon, the mechanical work is easy. It is easy, when the mechanical operation is seen, to say that it was obvious that certain mechanical arrangements would affect it; but mechanical arrangements are tried, and tried in vain, to reach a practical result, because the mechanical arrangement which is to effect such result is not yet seen. In looking at the completed thing, the mechanical operation is there; but the inventor, though he knew all about cams and levers, and other mechanical arrangements, did not have in advance before him the coveted mechanical operation.'

"To the same effect are the cases of Potts & Co. v. Creager, 155, U. S. 597, 15. Supt. Ct. 194, and Mast, Foos & Co. v. Dempster Mill Mfg. Co., 49 U. S. App. 508, 27 C. C. A. 191, and 82 Fed. 327."

The last expression of the Supreme Court of the United States in regard to this question is found in the opinion of the Supreme Court in the case of Expanded Metal Co. v. Bradford, decided June 1, 1909, not yet reported in the bound volumes of the Supreme Court Reports, but reported in the Official Gazette of the United States Patent Office of June 15, 1909 (Volume 143, page 865), where the Supreme Court states:

"The fact that the invention seems simple after it is made does not determine the question; if this were the rule many of the most beneficial patents would be stricken down. It may be safely said that if those skilled in the mechanical arts are working in a given field and have failed after repeated efforts to discover a certain new and useful improvement, he who first makes the discovery has done more than make the obvious improvement which would suggest itself to a mechanic skilled in the art, and is entitled to protection as an inventor. There is nothing in the prior art that
766 suggests the combined operation of the Golding patent in suit. It is perfectly well settled that a new combination of elements, old in themselves, but which produce a new and useful result, entitles the inventor to the protection of a patent. (Loom Company v. Higgins, 105 U. S. 580-591)."

Although we earnestly protested and objected of record to much of the incompetent, irrelevant or immaterial matter which the defendant undertook to inject into this record when taking its proofs before the Master on the accounting, which is found in the printed record in this case between pages 520 and 692, and much of which was merely a thinly-disguised attempt on the part of the defendant to show, on the proofs before the Master, that the invention the subject-matter of claim 4 of the patent in suit was neither novel nor useful, perhaps we are not mistaken in believing that that irrelevant, often incompetent, and thoroughly immaterial testimony, (all in the record and therefore liable to have been read) may possibly have had some weight in affecting the conclusions reached by the majority of the court in this case. But, standing on the record properly before the court in this case, and what the Circuit Court and Court of Appeals in the Carbide case found, after an earnest

contest made by the Wagner Company in that case, to have been suit, patented by Mr. Westinghouse on July 12, 1887, in the light of the then condition of the art, we find that invention to have been a most valuable one, marking a distinct advance in the art and consequently entitling the complainants to a liberal application of the doctrine of equivalents. Of that invention the Circuit Court in the Carbide case, 112 Fed. 417, after pointing out (page 418 of 112 Fed.) that the present defendant, the Wagner Electric & Manufacturing Company, of St. Louis, Missouri, furnished the infringing transformer to the defendant and may therefore be regarded as the defendant in the case, proceeds to consider the prior state of the art, as it existed prior to the year 1887, and the striking improvement in the art, practically speaking, that was made by Mr. Westinghouse in the invention the subject-matter of claim 4 of the patent in suit, and says, at 419 and 420 of 112 Fed., as follows:

"That improvements were needed to adapt the transformer to the manifold uses anticipated by those skilled in the art is not astonishing. The necessity of rapidly magnetizing and demagnetizing the core in a transformer resulted in the production of a great amount of heat, and a consequent loss of electrical energy. In order to obviate this difficulty, the plates which constitute the core were made of laminated iron, so as to suppress the Eddy currents in the core which caused the heating. This brings on a dis-
767 cussion of the patents in suit. The core of the Westinghouse patent is composed of thin plates of soft iron, in groups having sectional openings, and separated by thin sheets of paper or other insulating material. The insulating material is so arranged as to magnetically separate the plates in pairs. The method of constructing an induction coil or transformer having a core of thin plates is disclaimed by the patentee. It is not claimed to be new in the art to arrange a transformer so as to accomplish a means of ventilation of the parts, and thereby prevent a waste of energy through heating.

The claim is that by the arrangement of various known elements, and by the introduction of new elements, to-wit, dividing the iron into sections, and separating the coils, thereby increasing the surface over which heat dissipation in the core and coils may be carried on, aided by oil as an insulating material, and adding an inclosing case, a new combination, producing a new and beneficial result not before attained, is contributed to the art. The mechanical parts of the transformer are immovable and compact. They are so constructed as to enable the employment of a closed circuit of magnetic material. By this arrangement of the parts a superiority was undoubtedly obtained in durability, efficiency, and cheapness over prior transforming devices. The tendency of the transformers to become overheated, however, was an obstacle retarding their use for long-distance lighting, transmission of power, and other purposes. It was at this period that the Westinghouse patent in suit was conceived."

Then the Circuit Court, after showing that the combination, as

an entirety, was new, although made up of elements separately old, shows that under the doctrine of Cantrell v. Wallick, 117 U. S. 695, the thing claimed by claim 4 of the Westinghouse patent in suit was patentable. Cantrell v. Wallick is one of the leading cases which establishes the doctrine that a patent for a combination of old elements, where the combination, as an entirety, is new and the effectiveness of a machine is increased, is patentable; that the defendant's structure may infringe the patent in suit even if it contain improvements thereon, and even if the defendant has obtained a patent for his improvements. In it the Supreme Court says (117 U. S. 694):

"The first defence is based on the theory that a patent cannot be valid unless it is new in all its elements as well as in the combination, if it is for a combination. But this theory cannot be maintained. If it were sound no patent for an improvement on a known contrivance or process could be valid. And yet the great majority of patents are for improvements in old and well known devices, or on patented inventions. Changes in the construction of an
768 old machine which increase its usefulness are patentable. Seymour v. Osborne, 11 Wall. 516. So a new combination of known devices, whereby the effectiveness of a machine is increased, may be the subject of a patent. Loom Co. v. Higgins, 105 U. S. 580; Hailes v. Van Wormer, 20 Wall. 353. Two patents may both be valid when the second is an improvement on the first in which event, if the second includes the first, neither of the two patentees can lawfully use the invention of the other without the other's consent. Star Salt Caster Co. v. Crossman, 4 Cliff. 568."

Then, after showing the great practical advantage accomplished by the invention of Westinghouse, enabling transformers to be made of very much larger sizes, Judge Hazel says, 112 Fed. 420, as follows:

"I am of the opinion that the invention of Westinghouse, consisting of a combination of elements, unless anticipated by the prior state of the art, is a distinctive step forward in the progress of electrology, in the light of the immediate recognition which it received by the public. It does not seem to me, under the circumstances, to have been obvious to those skilled in the art."

Then, after referring to the patents of the prior art, which are the same as the patents introduced in evidence by the defendant in this case on the record as it stood at and before the interlocutory decree in the case at bar, Judge Hazel says, at page 422 of 112 Fed., as follows:

"Many of the patents cited to anticipate the Westinghouse patent relate to patents for dynamo-electric machines and other electrical devices, including transformers. None of them points out a way to dissipate the heat, although a number of them were designed to prevent waste energy produced by heat. In none of them is found the combination of elements contained in the Westinghouse patent in suit."

And Judge Hazel concludes his opinion as follows:

"The point is made by defendant that, inasmuch as various

claims contained in the original application filed in the patent office for the Westinghouse patent in suit were rejected by the commissioner of patents, were thereafter cancelled, and substitution of other claims allowed, the patentee conceded, among other things, that open spaces between the coils were not new, nor was it new to have gas or non-conducting fluid adapted to circulate through the spaces and about the transformer. All that may have been done by the patentee, yet a patent for a combination of old and new elements, co-operating together, was granted him by the patent office, and the presumption of patentability to which he is entitled
769 by reason thereof has not been overcome by the defendant.

The Westinghouse patent stated that the plates are preferably separated, and that it may be preferred in some instances to surround the transformer with oil or paraffin or other suitable material. It is stated by the patent that "the converter or transformer may be sealed in an inclosing case, and may or may not contain a non-conducting fluid or gas." It is insisted that these are matters of preference or recommendation only, and do not constitute essential features of the patent, but this, however, must be read with claim 4 of the patent. It is quite true that a feature which is mentioned only by way of recommendation in describing an invention must usually be considered as a subordinate, and not an essential part of the patent. Holliday v. Pickhardt (C. C.) 29 Fed. 853; Sewell v. Jones, 91 U. S. 171, 23 L. Ed. 275; Ansonia Brass & Copper Co. v. Electrical Supply Co., 144 U. S. 11, 12 Sup. Ct. 601, 36 L. Ed. 327, Krajewski v. Pharr, 44 C. C. A. 572, 105 Fed. 514. But the claim upon which complainant relies still clearly indicates the intention of the patentee to claim as essential the features described by the specifications as preferably employed."

When this Carbide case went to the Court of Appeals for the Second Circuit, Judges Wallace, Lacombe and Townsend, in the opinion written by Judge Townsend, (117 Fed. 495) affirmed in all respects the decree of the court below so far as the Westinghouse patent was concerned, and sustained claim 4 as a claim for a most valuable invention. After setting forth claim 4 and showing that that claim was filed with the original application and was never cancelled or modified, and that the prior state of the art did not anticipate or militate against the broad invention contained therein, the Court of Appeals finds the following important facts affecting the scope and validity of the invention, as follows:

"It appears that in the early history of the art only small converters were used, and the heat generated in them was dissipated by radiation into the surrounding air. But when the art began to call for converters exceeding 10 kilowatts in capacity, it was found, as stated by the expert for complainant, 'that the capacity of the transformer increased as the cube of the linear dimensions, and the heat, if the amount of loss was held stationary, would increase in like proportion, while the radiating surface would increase only as the square of the linear dimensions.' Further difficulties were encountered, resulting from the inequality of the conductivity of iron and copper. The testimony herein shows that these difficulties were so serious that for

some time it was feared that the practical limit of such transformers had been reached; that experiments were made by grouping, by the use of lower current densities, by filling the cases with oil,
770 and by subdividing the iron and copper parts of the converters by large ducts, and using forced drafts. It was only when, as the result of these experiments, it was found that the oil would circulate through the ducts that any practical progress was made. Then, as complainant's expert says, 'the problem of making large units became greatly simplified. It became only necessary to so subdivide the coils and iron so as to expose a uniform surface as compared with the losses in the transformer in all sizes, and to provide a case having sufficient external surface to enable the oil again to give up its heat to the surrounding air, to make transformers of any desired capacity.' The practical result of the invention in suit, as testified to by complainant's experts, was to so increase the capacity of converters that, while a dry converter, cooled by the natural circulation of air, is limited to 10 kilowatts, the oil-insulated converters of the patent in suit are commercially servicable up to 500 kilowatts."

In other words, the court in the Carbide case found that when Mr. Westinghouse made his invention the subject-matter of claim 4 of the patent in suit, granted July 12, 1887, at that time he had made an invention which, from a practical and commercial standpoint enabled converters which had theretofore been limited to a capacity of 10 kilowatts to be made commercially servic-able up to 500 kilowatts. Thereby bringing the unit of conversion up to a parity with those of generation and utilization, and removing a barrier which up to that time had proven insurmountable in the art. That is to say, that although the size of generators and motors had increased to several hundred kilowatts, that of converters, the necessary link between the generator and motor, remained stationary at about ten kilowatts, owing to the operation of natural laws, thereby necessitating the use of great banks of converters in order to utilize large and economical generators and, in consequence of the great expense of such necessity, destroying the advantage gained in the advance made in the construction of generators and motors. Designers and manufacturers, after many efforts, came to the conclusion that the art was permanently limited to a small transformer unit. But Westinghouse by the invention in suit removed the barrier, and while the means adopted by him may appear to be simple to wisdom after the event, yet, judged by its enormous practical results, his achievement was an invention of high rank and far more than usual merit. It marked not only a distinct advance in the art, but an enormous one, and such a one as the courts, other things being equal, have invariably held to be entitled to a liberal application of the doctrine of equivalents.

In view of the decision of the majority of the court in this case, and of the findings of fact made by the Circuit Court and
771 Circuit Court of Appeals in the Carbide case in respect to the invention of claim 4, we respectfully call this Court's attention to the leading case of Loom Company v. Higgins, 105 U. S.

580. In that case the invention was for a simple combination of known devices which resulted in giving the loom of the patent in suit a capacity of weaving 50 yards of carpet a day when before the loom could only weave 40 yards of carpet a day. Nevertheless, the Supreme Court found the Webster invention to be a most meritorious one and held that the defendant, who had not used the identical combination of the patent, had used a mechanical equivalent and therefore infringed. Contrasting the case of Loom Company v. Higgins with the invention of claim 4, we find that the comparison must necessarily result in showing that Westinghouse had made a very much more valuable improvement and a very much greater advance in *arc* art than did the patentee in the case of Loom Co. v. Higgins, and that therefore claim 4 is entitled to at least as broad a construction as was given to the Webster patent; for, although the capacity of the loom was only increased one-fourth, in the case of the Westinghouse invention the capacity of the transformer was increased from 10 kilowatts to 500 kilowatts.

With the wisdom which comes after the event, to paraphrase the language of the Supreme Court in the case of Carnegie Steel Co. v. Cambria Iron Co., 185 U. S. 446:

"It only remains now for the wisdom which comes after the fact to teach us that Westinghouse discovered nothing, invented nothing, accomplished nothing."

But if we apply the rule laid down in Loom Co. v. Higgins, to the facts as found by the Court of Appeals in the Carbide case at page 498 of 117 Fed., in the condition of the electrical art as it existed in 1887, we then find that Mr. Westinghouse did make a most valuable invention which was a distinct and radical step in advance in the electrical art, and that being true, this invention of claim 4 of the Westinghouse patent in suit is entitled to a broad range of mechanical equivalents, under the doctrine of Loom Co. v. Higgins, 105 U. S. 580, and Carnegie Steel Co. v. Cambria Iron Co., 185 U. S., 403; for it is a well-settled doctrine that in determining the question of infringement and the scope of the claim of a patent the question of mechanical equivalents is to be measured by the success achieved by the patented invention. Where the patentee has made a distinct step in advance in the art he is entitled to invoke broadly the doctrine of mechanical equivalents, and he is

772 not limited to the precise form or combination of parts illustrated in the drawings of his patent and described in the specification thereof

National Hollow Brake Beam Co. vs. Interchangeable Co. (decided by this Court) 106 Fed., 693, 710-716.

Columbia Wire Co. vs. Kokomo Steel & Wire Co., 74 C. C. A. 310.

This is also the doctrine recently reaffirmed by the Supreme Court of the United States in the case of The Paper Bag Patent, 210 U. S. 405, and recently affirmed by this Court of Appeals in its per curiam opinion in Denning Wire & Fence Co., Appellant, v. American Steel & Wire Co., Appellee, 169 Fed., 793, and by this Court of Appeals in Wayne Mfg. Co. vs. Benbow-Brammer Mfg. Co., 168 Fed., 271.

We believe that the majority of this court has erred in affirming the decision and decree of Judge Adams, so far as type M transformer is concerned, due to the fact that the majority of this court, as well as Judge Adams in the court below, failed to attach sufficient weight to the estoppel which arises on this record as against this defendant by reason of "the matters and things found and decreed" in the Carbide suit, which matters and things the defendant admits by paragraph VIII of its answer are res adjudicata against it; and it is quite possible that in this large record, in connection with the utterly irrelevant, immaterial or incompetent matter injected into the record by the defendant before the Master, the majority of the court may have been misled as to the nature and scope of the invention in suit. In the testimony before the Master Prof. Nipher and others, with the wisdom which comes after the event, did all they could to minimize the importance of the invention made by Mr. Westinghouse. The answer to all that testimony is that it was not competent evidence, or at least irrelevant and immaterial at that stage of the case, even if it were true, and could not be used to affect, at that stage of the case, the scope or validity of claim 4 of the patent in suit. The validity and scope of the invention of the patent in suit had been established in the Carbide case, and there was nothing in the evidence, up to and including the interlocutory decree in this case, affecting the scope or validity of claim 4 which was not before the court in the Carbide case. Furthermore "the matters and things found and decreed" in the Carbide case were, as the defendant admits by paragraph VIII of the Answer, res adjudicata against this defendant; and it is only necessary to refer to the decisions of the Circuit Court and Court of Appeals in the Carbide case to find that we
773 have not overestimated the great importance of the invention made by Mr. Westinghouse.

The majority opinion of this court quotes with emphasis at page 6 of its printed opinion the following passage from the opinion of Judge Adams:

"The use of oil or para-fine in a tank inclosing the transformer for the purposes just specified has been long known to the art, and is recognized by at least two patents prior to complainant's patent. Accordingly, the invention has for its main purpose only the physical means for effectually securing this circulation of oil."

We respectfully submit that the first sentence in the above extract from the opinion of Judge Adams hardly states accurately the nature of the invention made by Mr. Westinghouse, and, so far as it undertakes to refer to the prior state of the art, shows a condition which, if accurate, is utterly immaterial; while the last sentence in the above proposition involves a non sequitur. On the other hand, the entire opinion of Judge Adams seems to ignore the force and effect which should have been given to the things found and decreed in the Carbide case, by which findings the defendant is admittedly bound. As the Circuit Court and Court of Appeals point out in the Carbide case, it was not merely the use of oil, or merely the use of an inclosing tank for the transformer, or merely the open spaces in the core, which made the invention of Mr. Westinghouse, but it was the

entire combination of claim 4. Thus the Court of Appeals says (117 F. R. 497-8):

"Defendant's counsel chiefly rely on the Stanley patent, No. 349,612 of 1886, for an induction coil, in which, they say, they 'have the identical combination of the fourth claim of the Westinghouse patent.' This patent is for a converter. The plates of the core are so stamped as to form interior and exterior teeth. Of the plates the specification says:

'They are placed upon each other, the positions of the teeth coinciding; but they are insulated or separated from each other by paper, cloth, asbestos, oil silk, air, or other well-known insulating material, and they are firmly bolted or otherwise secured together.'

"The specification further says:

'The coil is preferably protected by being placed within a suitable case consisting of a base, F, to which there is secured a removable cover, F'. In the cover there are preferably former perforations, *f*, *f'*.

774 "Although the drawings do not show open spaces in the core, and defendant's expert assumes that there are no such spaces, yet it appears from the foregoing description that the patentee conceived the idea of a separation of the plates either so as to admit air or to provide for the insertion of some fabric for purposes of insulation. The description and drawings of the Stanley patent show a base plate and perforated cover adapted to ventilate the converter and to protect it from physical injury. We have, then, in the prior art every element of the combination claimed, and a physical combination of the same elements, except that the separations in Stanley are not adapted to, and the construction of the inclosing case is prohibitive of, the purpose of the claim in suit. This claim covers such an inclosing case as will confine the nonconducting fluid, and such open spaces in the core as will permit the circulation of the liquid through them. Westinghouse, then, was the first to patent such an air-tight, closed converter. Does the combination covered by the claim in suit show patentable invention? If the idea of ventilation be rejected, and the patent be confined to the statement of and claim for the inclosed construction, it embodies at least a combination radically modified from those of the prior art, in order to adapt it to a novel purpose. The primitive telegraph coils of the Brooks patent of 1878 were immersed in oil 'to protect them from the influence of the damp atmosphere'; and the Miller dynamo, without open spaces in its core, had its coils suspended in a 'tank of oil.' (There are the devices referred to by Adams, J., in the portion of his opinion quoted supra.) "But the construction of these devices excluded the novel idea of oil which would 'circulate through the tubes and intervening spaces of the coils and plates.' And while the assumed or suggested separations between the plates of the Stanley patent would be sufficient for insulation only, and not for circulation, its inclosing case is not sealed so as to contain the circulating oil, and the use of oil is not suggested. In these circumstances, the patentee seems to be entitled to claim the means by which the external and internal surfaces of the heat-producing parts of a converter

were cooled by such an arrangement and separation of parts as would permit the circulation about them of oil, and the means for the retention of said oil within and about said surfaces, whereby the heat from the oil radiated to the surrounding air. If there is any doubt upon the question of patentability, the practical and commercial results of this improvement must resolve such doubt in its favor."

It therefore appears that the foregoing quotation from Judge Adams' opinion, put in italics in the majority opinion of this court, does not state the nature of the invention nor the prior art correctly, and, even if correct, would not answer complainant's contention, even if the use of oil had been old in transformers, and even if the use of inclosing cases had been old. It remained for Mr. West-
775 inghouse to make such an arrangement and separation of parts as would permit the circulation about them of oil and the means for the retention of said oil within and about the said surfaces, whereby the heat from the oil radiated through the inclosing case to the surrounding air. This was found to be the invention of Mr. Westinghouse and the thing broadly covered by claim 4 by both courts in the Carbide case.

Furthermore, the last sentence in the extract from the opinion of Judge Adams quoted above involves a non sequitur. By that statement we understand the learned Judge to mean that although the patentee was new in his combination of devices claimed by claim 4, and although it resulted at the date of his patent, in 1887, in increasing the capacity of the transformer from 10 kilowatts to 500 kilowatts, nevertheless, even in the face of the results achieved, the patentee is limited to the particular physical means for *affecting* the circulation of oil described and illustrated in the patent. In other words, that claim 4 was literally limited to the particular means for permitting the circulation, that is to say, the exact and particular open spaces in the core illustrated in the patent and which are described as the preferable means. The patentee was bound, under Section 4888 of the Revised Statutes of the United States, to show one means of carrying his invention into effect; but having made an invention of the nature and character of the invention which Mr. Westinghouse did make, which the Circuit Court and Court of Appeals in the Carbide case found he did make, by which he increased the capacity of the transformer from 10 kilowatts to 500 kilowatts, which finding in the Carbide case is binding on this defendant, we respectfully submit that under the doctrine of Loom Co. v. Higgins, 105 U. S. 580, and under the doctrine of the Supreme Court in the Paper Bag patent case, 210 U. S. 405, and the case of Consolidated Valve Co. v. Crosby Valve Co., 113 U. S. 157, and by this court in numerous decisions, gauging the invention of Mr. Westinghouse by the success achieved, claim 4 is entitled to a fair construction, commensurate with the invention which the court in the Carbide case thus defines, at page 498 of 117 Fed.:

"The means by which the external and internal surfaces of the heat-producing parts of a converter were cooled by such an arrangement and separation of parts as would permit the circulation about them of

oil, and the means for the retention of said oil within and about said surfaces, whereby the heat from the oil radiated to the surrounding air."

If the invention just stated be the invention made by Mr. Westinghouse, and the Court of Appeals, in the Carbide case, said
776 it was precisely that, then, as the defendant admits by paragraph VIII of its answer that the things found and decreed in the Carbide case are binding upon the defendant, it would seem reasonably manifest that the defendant's type M transformer embodies in its construction that invention, and on a very limited application of the doctrine of mechanical equivalents infringes claim 4. It should be borne in mind that neither the construction of the type M transformer (which we claim to be a mere mechanical equivalent of the Westinghouse converter) nor any other construction capable of producing the improved results, existed before the invention in suit. It follows, then, we most respectfully submit, that the opinion of Judge Adams, which held type M transformer no infringement of claim 4, was erroneous, and that, for the same reasons, the majority opinion of this court is in error.

It is clearly erroneous, in view of Section 4888 of the Revised Statutes of the United States, of the terms of the specification, of the form of claim 4, as well as of the history of that claim, and of the distinct and important results achieved by the invention of claim 4, to limit the scope of that invention to the particular "physical means for effectually securing this circulation of oil" which are illustrated and described in the patent as the preferable means for accomplishing the desired result. Such a narrow construction of claim 4 does violence to certain established facts in this record, binding on this defendant, to the statute (Section 4888), and to the rules of law established by the Supreme Court and by this Court in Hollow Brake Beam case (See 106 Fed. page 715).

Under Section 4888 R. S. U. S., Mr. Westinghouse, having made a new and useful machine, was obliged, in order to secure his patent, to show and describe its principle of operation or modus operandi and what he conceived to be the best mode of applying that principle, and then to claim, not the abstract principle, but the machine which embodied that principle. Having done this, the following rule of law formulated by the United States Supreme Court, expressed in Winans v. Denmead, 15 Howard 342, is directly applicable:

"It is generally true, when a patentee describes a machine and then claims it as described, that he is understood to intend to claim, and does by law actually cover, not only the precise forms he has described, but all other forms which embody his invention, it being a familiar rule that, to copy the principle or mode of operation described is an infringement, although such copy should be totally unlike the original in form or proportions."

777 The doctrine of the case of Winans v. Denmead, 15 Howard 330, has been repeatedly affirmed by the United States Supreme Court in recent years, with specific reference to that particular decision, notably in the cases of Western Electric Co. v. LaRue, 139 U. S. 606, and Hoyt v. Horne, 145 U. S. 309. In each of these cases

the claim of the patent sustained was for a combination of devices resulting in a new machine having improved results. In both of these cases the defendant did not use the exact things called for by the terms of the claim in controversy, bu the mechanical equivalents thereof. In each of these cases the defendant was operating under a later patent granted on the form of defendant's device in which was embodied, in a different form, the essentials of the complainant's patent. (In the case at bar, except by the patent in suit, there is no patent on type M transformer). Nevertheless, in each of these cases, under the doctrine of Winans v. Denmead, the Supreme Court found that although the defendant had avoided the letter of the claim of the complainant's patent it had nevertheless infringed the patent by the use of mechanical equivalents.

In the case of Hoyt v. Horne, the Supreme Court says at page 309 of 145 U. S.:

"An additional function is claimed for the Horne device in the fact that the pulp, falling as it descends the dam from a vertical to a horizontal plane in a kind of torsional current, is more thoroughly mixed than in the Hoyt device, where the pulp continues to flow in parrallel lines from the time it is delivered by the beater-roll to the time it is received by it again. This may be true, and defendant's engine may be in this particular an improvement upon the other; but he has none the less succeeded in appropriating all that was of value in the Hoyt device, viz.: the beater-roll at the end of the tub, extending across its entire width, and the circulation of the pulp in vertical planes at the only point where such circulation is of value. The substitution of a vertical for a horizontal mid-feather at the inoperative end of the tub is merely the use of an old and well known mechanical equivalent, and obviously intended to evade the wording of the claims of the Hoyt patent. Winans v. Denmead, 15 How. 330. Indeed, the ingenuity displayed in this evasion is only equalled by the ingenuity with which it is concealed in the specification of the defendant's patent, and the function of a more thorough mixture of the pulp put forward as the salient feature of the invention."

In the case of Western Electric Co. v. LaRue, on this question of the construction of a claim and its infringement, the Court says at pages 605-7 of 139 U. S. as follows:

"The question of infringement turns upon the construction to be given to the third claim of the patent, which is, in terms, for
778 the combination, in a telegraph key, of a lever fulcrumed upon a torsional spring, with adjusting screws for regulating its movement. If this claim be limited strictly to a telegraph key, by which is understood the instrument which is used at the office of transmission for sending off messages, then it is clear that defendant does not infringe, since it makes use of a similar combination only in connection with a telegraph sounder, or instrument used at the receiving office for delivering or enunciating the message. It is evident, however, that both of these patentees understood that the combination described in their patents could be used in either connection, since Edwards says in his specification that he does not limit

himself 'to the application of torsional springs to telegraph keys alone, as it is obvious the torsional strip or spring may be applied to other electrical instruments. Thus it may replace the pivots or trunnions of the relay and sounder.' Haskins also admits that 'it has heretofore been proposed to support a lever of a key or an armature upon a flat torsional spring,' and says that his 'torsion-spring may be applied to the armature-lever of any telegraphic receiving-instrument, or to the lever of any telegraphic key, without departing from the spirit of the invention.'

The use of the combination is practically the same in both instances. There are the same elements of a lever fulcrumed upon a torsional spring, and adjusting screws for regulating the amplitude of the lever movement, and the retractile resistance of the torsional spring. They are used for purposes which differ principally in name. The key transmits the message, the sounder receives it. The material part of the key is a lever which completes and breaks an electric circuit; the sounder consists merely of a lever which completes and breaks a magnetic circuit. In both cases, the lever is riveted to and supported by a flat torsional spring, which is itself supported at its ends upon upright posts, to which it is fastened by screws. The object of the spring in each instance is to allow the lever to play back and forth between the exceedingly narrow limits fixed by the set screws. The employment of this spring in connection with the sounder is such a new or double use as would occur to an ordinary mechanic who had seen the Edwards key in operation. It brought into play no faculty of invention. While the promotion of an old device, such, for instance, as a torsional spring, to a new sphere of action, in which it performs a new function, involves invention, the transfer or adaptation of the same device to a similar sphere of action, where it performs substantially the same function, does not involve invention.

Against this new and analogous use of his combination, the patentee is as much entitled to protection as if the word 'sounder' had been expressly inserted in his claim. Since the case of Winans v. Denmead, 15 How. 330, it has been the settled doctrine of this court, as expressed in the opinion of Mr. Justice Curtis, p. 779 343, that 'the patentee, having described his invention and shown its principles, and claimed it in that form which most perfectly embodies it, is, in contemplation of law, deemed to cla-m every form in which his invention may be copied, unless he manifests an intention to disclaim some of these forms.' This is practically restated in different language in subsequent cases, and amounts to a declaration that the application of the patented device to another use, where such new application does not involve the exercise of the inventive faculty, is as much an infringement as though the new machine were an exact copy of the old. Sewall v. Jones, 91 U. S. 171, 183; Howe v. Abbott, 2 Story, 190; Walter v. Potter, Webster Pat. Cas. 585.

Some stress is laid by the defendant upon the fact that the 'circuit-breaking' lever is made an ingredient of the first, second, and fourth claims of the patent, and that as the sounder has no

circuit-breaking lever, but only an armature-lever, there is no infringement. Assuming, however, what as a matter of fact seems doubtful, that the lever of the sounder is not a circuit-breaking lever, the objection loses all its force in view of the language of the third claim, the only one found to be infringed, in which the limitation of the circuit-breaking lever is omitted, and a 'lever fulcrumed upon the torsional spring' is substituted."

Applying the above principles to the Westinghouse patent in suit and the defendant's type M transformer, it matters not, even if it be technically true, that, strictly speaking, the defendant's M transformer does not have "open spaces in its core;" for the defendant's type M transformer has the mechanical equivalent of that feature of claim 4 of the Westinghouse patent in suit. Clearly, the invention of claim 4 is the invention which the Court of Appeals in the Carbide case found it to be, and which that court expressed in these words (117 F. R. 498):

"In these circumstances, the patentee seems to be entitled to claim the means by which the external and internal surfaces of the heat-producing parts of the converter were cooled, by such an arrangement and separation of parts as would permit the circulation about them of oil, and the means for the retention of said oil within and about said surfaces, whereby the heat from the oil radiated to the surrounding air."

And the practical result of this invention having been what the Court of Appeals in the Carbide case states it was:

"to so increase the capacity of converters that, while a dry converter, cooled by the natural circulation of air, is limited to 10 kilowatts, the oil insulated converters of the patent in suit are commercially serviceable up to 500 kilowatts,"

780 and treating claim 4 with only a fair degree of liberality in its interpretation, in view of the success achieved in 1887 by reason of this particular invention, it follows that even if the defendant's type M transformer does not technically and in an exact sense have "open spaces in its core," it does have the full mechanical equivalent thereof, and it does have the definition of the invention given by the Court of Appeals in the Carbide case, "such an arrangement and separation of parts as will permit the circulation about them of oil, and the means for the retention of said oil within and about said surfaces whereby the heat from the oil radiated to the surrounding air."

On page 5, of opinion, citing from Water Meter Co. v. Desper, 101 U. S. 332, the majority says: that every recited element of a combination is material, and hence argues that we cannot say that the open spaces in the core are immaterial and may be omitted.

But we do not say this. We say that the omitted part may be substituted by a mechanical equivalent, and that this is what defendant here has done; that is to say, that in substituting longitudinal open spaces through the core (i. e., the spaces between the coils and the core), for the transverse open spaces shown in the patent, defendant substitutes a mechanical equivalent therefor, namely, one

that accomplishes the same result in the same way, and, as an equivalent is the same as the thing itself (Machine Co. v. Murphy, 97 U. S. 125), its type M transformer embodies the claim in suit.

On page 5, the majority opinion cites with approval Judge Adams' remark, as follows:

"No doctrine of equivalency can dispense with the open spaces in the core of the transformer, for they are a necessary element of the combination."

We would assent to this statement cheerfully, except that both Judge Adams and the majority hold that it is the core itself as a separate entity that must have open spaces in it and that such open spaces must be separate from and other than the coil openings. But the claim 4 in suit does not call for such a core. It calls for "an electric converter constructed with open spaces." So that it is the converter that is constructed with open spaces; not the core. These open spaces are located in the core. In defendant's brief on appeal, page 49, counsel defines "in," as in Century Dictionary, as "Within the bonds or limits of." When defendant constructs its type
781 M converter with the spacing strips between the inner sides of rectangular core openings and the sides of the coils so as to leave open spaces between the coils and core, and makes the coils smaller for that purpose, it is constructing an electric converter with open spaces "in," that is, "within the bounds or limits of" its core. And the oil in such converter circulates through "the intervening spaces of the coils and plates, and preserves the insulation, excludes the moisture, and cools the converter," as set forth in the patent in suit.

It is error to say that because a claim describes a certain element of a combination by certain characteristics of construction, such characteristics may not be absent from an infringing device. This is because the infringing device is the mechanical equivalent. It is only by defining the expression "in its core" to mean openings in the legs of the core and by holding that nothing could be an equivalent to openings in the legs of the core, that such a statement as that "no doctrine of equivalency can dispense with" them, above quoted, could be made.

But a hasty glance at the authorities will show that there is no warrant for such a doctrine. Thus in Winans v. Denmead (15 Howard, 315), the claim of the patent was limited to a round car body and the patent illustrated only that form; but the Supreme Court held that the defendant infringed by the use of a hexagonal car body, on the ground that it was an equivalent. Here the round body was a necessary element of the claim, but was dispensed with by the doctrine of equivalency. So also in the case of Forgie v. Duff, 81 F. 865 (C. C. A., Third Circuit), the claims in suit specified as an element of the combination, "a yielding tripping plate," while the defendant's device had a rigid plate with spring fingers placed thereon to trip the pawls. Here the yielding tripping plate although the only device described in the patent, and although specified in the claims as an element of the combination and necessary therein, yet was dispensed with by the doctrine of equivalency.

The doctrine of Winans v. Denmead has also been expressly affirmed, by deference to that particular decision, in numerous recent cases decided by the U. S. Circuit Court of Appeals, notably in the cases of Ryder v. Schlichter, 126 Fed. 492; Columbia Wire Co. v. Kokomo Wire Co., 143 Fed. 122; Universal Brush Co. v. Sonn, 146 Fed. 531.

In the case of Brammer v. Schroeder, 106 Fed. 918, 46 C. C. A. 44, this Court of Appeals says:

782 "If, however, one invents and secures a patent for a new combination of old mechanical elements which first performs a useful function, he is protected against all machines and combinations which perform the same function by equivalent mechanical devices to the same extent and in the same way as one who invents and patents a machine or composition of matter of like primary character. The doctrine of mechanical equivalents is governed by the same rules and has the same application when the infringement of a patent for a combination is in question as when the issue is over the infringement of a patent for any other invention. Imhaeuser v. Buerk, 101 U. S. 647, 653, 25 L. Ed. 945; Griswold v. Harker, 62 Fed. 389, 391, 10 C. C. A. 435, 437, 27 U. S. App. 122, 150; Thomson v. Bank, 53 Fed. 250, 253, 3 C. C. A. 518, 521, 10 U. S. App. 500, 509; Seymour v. Osborne, 11 Wall. 516, 542, 548, 20 L. Ed. 33; Gould v. Rees, 15 Wall. 187, 189, 21 L. Ed. 39; Fay v. Cordesman, 109 U. S. 408, 420, 3 Sup. Ct. 236, 27 L. Ed. 979; Water-Meter Co. v. Desper, 101 U. S. 332, 25 L. Ed. 1024; Gage v. Herring, 107 U. S. 640, 2 Sup. Ct. 819, 27 L. Ed. 601; Machine Co. v. Murphy, 97 U. S. 120, 24 L. Ed. 935; National Cash Register Co. v. American Cash Register Co., 53 Fed. 367, 373, 3 C. C. A. 559, 565, 3 U. S. App. 340, 357; Belding Mfg. Co. v. Challenge Corn Planter Co., 152 U. S. 100, 14 Sup. Ct. 492, 38 L. Ed. 370."

Clearly, in view of the decisions of the Circuit and Circuit Court of Appeals in the Carbide case, and especially in the light of what the Court of Appeals says as to the nature of this invention and its valuable contribution to the electrical art in 1887 (the date of the patent), it would seem manifest that the invention made by Mr. Westinghouse and covered by his fourth claim is for a new and useful invention performing a most valuable and important function or result, and that in the defendant's type M transformer, although the defendant has not used the preferable form referred to in the patent and the specific form illustrated in the drawings thereof, it has copied the principle of that invention by the use of mechanical equivalents.

And even if it be true (though we do not admit it as a fact) that the defendant in its type M transformer, although embodying the invention of claim 4, had improved thereon, nevertheless the defendant has infringed the patent; for, as the Court of Appeals says in the case of Columbia Wire Co. v. Kokomo Wire Co. at the foot of page 123 of 143 Fed.:

"So, assuming that it is an important improvement (which is disputed in the appellant's testimony), and patentable as an improvement, its association with the means of the prior patent is unauthor-

ized without license from such patentee. Cochrane v. Deener,
783 94 U. S. 780, 787, 24 L. Ed. 139; Cantrell v. Wallick, 117 U. S. 689, 694, 6 Sup. Ct. 970, 29 L. Ed. 1017; Hoyt v. Horne, 145 U. S. 302, 309, 12 Sup. Ct. 922, 36 L. Ed. 713; Walker on Patents (3rd Ed.) Sec. 347."

The principles which we invoke and the doctrine of the cases which we have just cited, is not only the doctrine of this Court of Appeals in the celebrated and leading case of National Hollow Brake Beam Co. v. Interchangeable B. B. Co., 106 Fed. 693, but is the same doctrine which is applied and affirmed by this court in its unanimous opinion handed down March 6, 1909, and reported in 168 Fed., the case of Wayne Mfg. Co. v. Benbow-Brammer Mfg. Co., 168 F. R. 271.

Every invention must take expression in some form, but, nevertheless, every patent for an invention is not limited to the precise form in which it is illustrated and described in the patent. Mr. Westinghouse embodied the invention of claim 4, in the form illustrated in his patent, with a structure which had literally and exactly open spaces in the core of the transformer, and put such a transformer in an inclosing case with oil so as to obtain the circulation and thus accomplish the desired result. But the invention made by Mr. Westinghouse was broader than that particular form, and was the invention defined by the Court of Appeals in the Carbide case at page 498 of 117 Fed. as:

"such an arrangement and separation of parts as would permit the circulation about them of oil, and the means for the retention of said oil within and about said surfaces, whereby the heat from the oil radiated to the surrounding air."

All that defendant did, so far as its type M transformer is concerned, was to take that invention and accomplish the same result by taking the spacing strips from between the groups of core plates and placing them between the coils and the core, thus putting into effect, in a slightly different form, precisely the invention defined by the Court of Appeals in the Carbide case and which we have just described above. This only serves to illustrate, as in Winans v. Denmead and by this Court in Brake Beam Case (See pages 713-714 of 106 Fed.) that it was perfectly possible to embody the invention of Mr. Westinghouse in a different form, by the use of mechanical equivalents, without using the precise and preferable form which Mr. Westinghouse described in his specification and illustrated in his drawings; but this could only be done by the use of mechanical equivalents—precisely what the defendant did in making its type M transformer. If the defendant's type M transformer has not, technically, open spaces in its core, it certainly has the mechanical equivalent thereof within the rule laid down by
784 the Supreme Court in Winans v. Denmead and followed in numerous cases, only some of which we have deemed it necessary to cite here.

We are aware that the majority of the court in its opinion, in discussing the question relating to the accounting feature of this case, says a thing which, we most respectfully submit, is not war-

ranted by the patent in suit, and may have had some weight in affecting the conclusions reached by this court as to type M transformer not being an infringement of claim 4; we refer to the following quotation taken from the foot of page 8 and top of page 9 of the printed opinion in this case:

"The evidence clearly shows, we think, that the thing principally to be desired in the construction of a transformer is to keep the coils rather than the core from becoming overheated. The appellant's patent, Claim Four, seems to have proceeded upon the idea that the thing principally to be accomplished was to keep the core from becoming over-heated and to that end it provided that one element of the combination covered by Claim Four was to be the open spaces in the core, nothing whatever being said in that claim about open spaces between the coils or about open spaces between the core and the coils."

Whatever the evidence may show in this respect, and that was only evidence on the accounting feature of the case and should have nothing to do with our appeal from that part of the interlocutory decree which failed to find type M transformer an infringement of claim 4, we respectfully submit that the conclusions reached and stated by the court, quoted above, are unwarranted by the patent, and are inconsistent with what was found to be the invention of claim 4 by the Court of Appeals in the Carbide case. The specification of the Westinghouse patent nowhere states that the thing principally desired is to keep the core, rather than the coils, from becoming overheated. On the contrary, it would be clearly within the scope of the invention illustrated, described and claimed by the Westinghouse patent to have spaces between the coils and between the coils and the core alone, or in addition to the specific opening-up of the core which is referred to in the Westinghouse patent as the preferable construction and is made a feature of claim 4. Indeed, the specification distinctly says, beginning at line 65:

"Preferably also the primary and secondary coils c' c^2 are separated from each other in a similar manner,"

the preceding sentence showing that in the preferable construction the groups of plates constituting the core are blocked apart at
785 intervals. In stating the object of the invention, the patent states, beginning at line 16:

"The object of this invention is to provide a simple and efficient converter which will not become overheated when employed for a long time in transforming currents of high electro-motive force, and which will be thoroughly ventilated."

It was, therefore, within the scope of the invention and in harmony with its stated object to accomplish the desired result either by the preferable construction described in the patent or by making spaces not only between the coils but also between the coils and the core. Indeed, practically speaking, as these structures are made, and in the light of the purpose or object of this invention, it was a natural expedient, and almost an incident of the Westinghouse construction—certainly not a departure from it—not only to have

the spaces between the coils referred to in the specification beginning at line 65, but also space between the coils and the core. Indeed, this is precisely in harmony with the invention as defined by the Court of Appeals in the Carbide case, viz.:

"such an arrangement and separation of parts as would permit the circulation about them of oil, and the means for the retention of said oil within and about said surfaces, whereby the heat from the oil radiated to the surrounding air."

To paraphrase the language of the Supreme Court in the case of Crosby Valve Co. v. Safety Valve Co., at page 449 of 141 U. S., in which case the Supreme Court sustained the Richardson valve patent broadly, although it involved only a very slight change in valves of the prior art, but that slight change effected such substantial results that the results reflected back upon the invention and characterized it as a most valuable one, we may well say here: Taught by Westinghouse, by the use of his apparatus it was not difficult for the defendant to take prior structures and so arrange and use them as to produce the beneficial results first made known by Mr. Westinghouse; but prior to 1887, though all these old patents and their descriptions were accessible, as the Court of Appeals found in the Carbide case, no transformer was ever made producing any such results.

We have already seen from the decisions of the Supreme Court that it is immaterial, even if it be true, that the defendant's type M transformer was an improvement upon the particular and preferable form of the embodiment of the invention of Mr. Westinghouse illustrated in his patent. It is a well-settled principle, recognized by the authorities heretofore cited and by the following cases, that where the defendant's structure embodies the under-
786 lying principle or conception of the patentee's invention, it is immaterial that the defendant's structure accomplishes the results of the patentee's invention in a better or in an inferior manner. See Kitselman v. Kokomo Fence Machine Co., 108 Fed. 630-659, and the case of Nathan v. Howard, 143 Fed. 893, both of which are decisions of the United States Circuit Court of Appeals. In the latter case, among other decisions, the court cites the case of Winans v. Denmead, 15 Howard, 330-343, quoting the following language from the decision of the Supreme Court in the case of Winans v. Denmead:

"In our judgment, the only answer that can be given to these questions is that it must be so near to a true circle as substantially to embody the patentee's mode of operation and thereby attain the same kind of result as was reached by his invention. It is not necessary that the defendant's cars should employ the plaintiff's invention to as good advantage as he employed it, or that the result should be precisely the same in degree. It must be the same in kind, and effected by the employment of his mode of operation in substance."

Not only is the rule of law so clearly stated in Winans v. Denmead and followed in the cases cited supra, applicable to the established facts in this case, but, in describing the invention of claim

4, Mr. Westinghouse was careful to set forth in his specification that the form in which he had embodied and illustrated his invention was merely a preferable form. He first sets forth the general object of his invention, in the specification of his patent, lines 15 to 21, in these words:

"The object of this invention is to provide a simple and efficient converter which will not become overheated when employed for a long time in transforming currents of high electro-motive force, and which will be thoroughly ventilated."

Then, in complying with Section 4888 of R. S. U. S. and describing one form of machine in which his invention was embod-ed, he is most careful to show that that form or embodiment of his invention is merely his preferable form, describing this invention in the specification of his patent, between lines 41 and 85, as follows:

"The plates are preferably constructed with two rectangular openings, e' and e^2, through which the wires pass. For convenience in inserting the coils, or rather in applying the plates to the coils after the latter have been wound, a cut is made from each opening, as shown at b b. By bending the ends c c upward the plates may then be thrust into position, and the ends c c then close about the coils. The tongues e^3 of succeeding plates are preferably inserted from opposite sides. I do not, however, herein broadly claim
787 an induction coil having its core constructed of thin plates formed in the manner just described; but such invention is claimed in an application of even date herewith, filed by Albert Schmid. Each group of—say five or six—plates thus applied is preferably separated from the succeeding group by air spaces. These may be produced by passing tubes f' f', which may be of soft iron or other metal, or of vulcanized fiber, along the lengths of the plates. It may be sufficient in other instances to block the group of plates apart at intervals instead of extending the tubes the entire length. Preferably also the primary and secondary coils C' C^2 are separated from each other in a similar manner. In this instance blocks or tubes f^2, of non-conducting material, are used. The tubes may be perforated, as shown at f^3 f^3. Where the converter is to be used in open air, the tubes f' and f^2 would permit a free circulation of air, and thus aid in keeping the converter cool.

It may be preferred in some instances to surround the converter with some oil or paraffine or other suitable material, which will assist in preserving insulation and will not be injured by heating. This material when in a liquid form circulates through the tubes and the intervening spaces of the coils and plates, and preserves the insulation, excludes the moisture, and cools the converter.

The entire converter may be sealed into an inclosing case, H, which may or may not contain a non-conducting fluid or gas."

In claiming this invention broadly, in order to comply with Section 4888 of R. S. U. S., Mr. Westinghouse had to refer to it by reference to the embodiment of the invention as described in the specification, but, nevertheless, as pointed out by the Supreme Court in the case of Winans v. Denmead, page 342 of 15 Howard, in construing that claim "he is understood to intend to claim, and does by law actually

cover, not only the precise forms he has described, but all other forms which embody his invention, it being a familiar rule that, to copy the principle or mode of operation described is an infringement, although such copy should be totally unlike the original in form or proportions." See also what this court says in Brake Beam Case, at pages 713-714 of 106 Fed. With this rule of law in contemplation, Mr. Westinghouse made claim 4 in the following words:

"4. The combination, substantially as described, of an electric converter constructed with open spaces in its core, an inclosing case, and a non-conducting fluid or gas in said case adapted to circulate through said spaces and about the converter."

It is also a significant fact established on this record and referred to by the Court of Appeals in the Carbide case, at the foot of
788 page 496 of 117 Fed., that the above claim 4 "was filed with his original application, and was never cancelled or modified." It is also a significant fact commented on by the courts in analogous cases that claim 4 is the broadest claim of all, not claiming details of construction and is the only claim in the patent covering the converter, the inclosing case and the non-conducting fluid, as an entirety, thereby covering the means or mechanism "by which the external and internal surfaces of the heat-producing parts of the converter were cooled, by such an arrangement and separation of parts as would permit the circulation about them of oil, and the means for the retention of said oil within and about said surfaces, whereby the heat from the oil radiated to the surrounding air." The limited structural claims are claims 1, 2 and 3, none of which is in issue here. In claim 1 the primary and secondary coils are referred to as having an open space intervening between them. In claim 2 the core is described as of lamina of soft iron, arranged in groups, said groups being separated by open spaces; and in claim 3 the core is described as composed of soft iron plates arranged in groups and open tubes intervening. The fact that such limitations are present in claims 1, 2 and 3 and absent from claim 4 makes it clear that it was not the intention of the patentee, in and by claim 4, to limit himself to the precise mechanism or means for accomplishing the object of his invention set forth in his specification, but that he intended to cover the equivalents thereof. And this is precisely what the Supreme Court says he is entitled to cover, in the quotation which we have made above from the decision in the case of Winans v. Denmead, 15 Howard 342. Especially is this so in view of the fact that in the Carbide case the Court of Appeals found (see page 498 of 117 Fed.) that the invention of claim 4 was broadly for "such an arrangement and separation of parts as would permit the circulation about them of oil, and the means for the retention of said oil within and about said surfaces, whereby the heat from the oil radiated to the surrounding air;" and it was this invention which the Court of Appeals found (See foot of page 498 of 117 Fed.) to have resulted, in 1887, in so increasing the capacity of converters that while a dry converter, cooled by the natural circulation of air, is limited to 10 kilowatts, "the oil-insulated converters of the patent in suit are commercially servic-able up to 500 kilowatts."

It thus does violence to the general rule of construction applicable to claims of letters patent, where there are several claims, to the effect that if some of the claims are limited to details those which remain are prima facie not to be fettered by insisting that they con-
789 tain, as necessary elements, the particulars which are specifically covered elsewhere, to read into claim 4, as essentials, the precise physical means for effectually securing this circulation of oil, which means are described and illustrated in the patent as preferable means. That this rule of law is well established, we refer to the decision of the Circuit Court of Appeals in Bresnahan et al. v. Tripp Co., 102 Fed. 900.

It is also true, as we have already pointed out, that in construing the claims of a patent the Court is justified in considering the success achieved; and the Court of Appeals in the Carbide case, that the success achieved by the invention the subject-matter of claim 4 of the Westinghouse patent in suit was in increasing the capacity of electrical converters, at the date of the patent in suit (1887), from 10 kilowatts to a capacity of 500 kilowatts. Therefore, in considering the invention from the standpoint of the wonderful success achieved, we are entitled to invoke, and do invoke, the doctrine and the principles laid down by the Supreme Court in the case of Morley Machine Co. v. Lancaster, 129 U. S. 263, and the cases there cited; notably the case of Consolidated Valve Co. v. Crosby Valve Co., 113 U. S. 157, which the Supreme Court discusses in the Morley Machine cases at pages 276 and 277 of 129 U. S. The rule which we invoke, and which the facts in this case warrant us in invoking, and which is departed from in the majority opinion of this court, is the rule laid down by this Court of Appeals in an opinion handed down February 25, 1909, in the case of J. L. Owens Co. v. Twin City Separator Co., and thus stated in the report of that case at pages 266 and 267 of 168 Fed.:

"But counsel contends that the defendant escapes infringement because in the specification of his patent and in his drawings Froslid shows a lap deck composed of a rigid element, such as a zinc plate, about half as long as the deck, and a flexible apron or flap, the head end of which is fastened to the head end of this plate while the remainder of it rides upon the sieve below and holds the oats in a horizontal position. But the description in a specification or drawing of a form, or a composition, or construction, of a mechanical element, when that form, composition, or construction is not, and is not claimed to be, essential to the combination or improvement claimed, is the mere pointing out of the best mode in which the patentee contemplated applying the principle of his invention under section 4888, Rev. St. (U. S. Comp. St. 1901, p. 3383), and does not deprive him of protection for mechanical equivalents or indicate that he intended to give up all other modes of application. Continental Paper Bag Co. v. Eastern Paper Bag Co., 210 U. S. 405, 418, 28 Sup. Ct. 748, 52 L. Ed. 1122; National Hollow Brake Beam Co. v. Inter-
790 changeable Brake Beam Co., 45 C. C. A. 544, 566, 106 Fed. 693, 715; City of Boston v. Allen, 91 Fed. 248, 249, 33 C. C. A. 485, 486.

Again, in the claim in suit, the patentee does not specify or claim the two elements of the lap deck, but claims the lap deck simply as one element of his combination; while in his second claim, that is not here in suit, he specifies and claims the rigid element and the flexible element of a lap deck as elements of the combination there described; and where a patent contains a general claim for a combination of certain mechanical elements and a specific claim for a combination of a specified form, composition, or construction of one of those elements with the other elements of the general claim, the legal presumption is that the two claims secure different combinations, and the general claim is not limited to the specific form, composition, or construction claimed in the specific claim, but protects the element and its mechanical equivalents, though in form, composition, or construction differing from that of the specific claim.

Mere changes of the form or composition of a device or of some of the mechanical elements of a combination will not avoid infringement, where the principle or mode of operation of the patented improvement or combination is adopted, unless the form or composition is the distinguishing characteristic of the invention. Columbus Watch Co. v. Robbins, 64 Fed. 384, 396, 12 C. C. A. 174, 187; New Departure Bell Co. v. Bevin Bros. Mfg. Co. (C. C.) 64 Fed. 859; Machine Co. v. Murphy, 97 U. S. 125, 24 L. Ed. 935; Winans v. Denmead, 15 How. 342, 14 L. Ed. 717; Robinson on Patents, Sec. 141, p. 201; Blandy v. Griffith, 3 Fed. Cas. p. 678, No. 1,529; Bonnette Arc Lawn Sprinkler Co. v. Koehler, 82 Fed. 431, 27 C. C. A. 200; National Hollow Brake Beam Co. v. Interchangeable Brake Beam Co., 45 C. C. A. 544, 562, 106 Fed. 693, 711.

'If two devices do the same work in substantially the same way and accomplish substantially the same result, they are the same, even though they differ in name, form, or shape.' Machine Co. v. Murphy, 97 U. S. 125, 24 L. Ed. 935."

In view of the valuable character of the invention of claim 4, measuring the invention by the success achieved, and looking at the matter from the condition of the art as it existed in 1887, when the Westinghouse patent was granted, and recognizing that the Wagner Company is bound by the things found and decreed in the Carbide case, we respectfully submit that a careful reading of the recent opinion of the Supreme Court of the United States in the case of Continental Paper Bag Co. v. Eastern Paper Bag Co., 210 U. S. 405, will clearly show that the opinion of the majority of this court in
791 the case at bar is in conflict with the rules governing the interpretation of claims and the doctrine of mechanical equivalents as there laid down. In the said case, at page 418 of 210 U. S., the Supreme Court says:

"We think it is clear that the court considered that Liddell sought to comply with Sec. 4888 of the Revised Statutes. In other words, he filed a description of his invention, explained its principle and the best mode in which he 'contemplated applying that principle,' and did not intend to give up all other modes of application. An inventor must describe what he conceives to be the best mode, but

he is not confined to that. If this were not so most patents would be of little worth."

We also quote from pages 414 and 415 of 210 U. S. as follows:

"The lower courts did not designate the invention as either primary or secondary. They did, however, as we shall presently see, decide that it was one of the high rank and entitled to a broad range of equivalents. It becomes necessary, therefore, to consider the point of law upon which petitioner contends the question of infringement depends.

The citation is from Cimiotti Unhairing Company v. American Fur Refining Company, 198 U. S. 399, and the Kokomo Fence Machine Case, 189 U. S. 8, was adduced to sustain the proposition. But the whole opinion must be considered, and it will be seen from the language which we shall presently quote that it was not intended to say that the doctrine of equivalents applied only to primary patents.

We do not think it is necessary to follow counsel for petitioner in his review of other cases which, he urges, sustain his contention. The right view is expressed in Miller v. Eagle Manufacturing Company, 151 U. S. 186, 207, as follows: 'The range of equivalents depends upon the extent and nature of the invention. If the invention is broad and primary in its character, the range of equivalents will be correspondingly broad, under the liberal construction which the courts give to such inventions.' And this was what was decided in Kokomo Fence Machine Case, supra, Cimiotti Unhairing Company v. American Fur Refining Company, supra, and Computing Scale Company v. Automatic Scale Company, 204 U. S. 609. It is from the second of those cases, as we have seen, that the citation is made which petitioner contends the point of law upon which infringement depends is formulated; but it was said in that case: 'It is well settled that a greater degree of liberality and a wider range of equivalents are permitted where the patent is of a pioneer character than when the invention is simply an improvement, may be the last and successful step, in the art theretofore partially developed by other inventors in the same field.'

It is manifest, therefore, that it was not meant to decide
792 that only pioneer patents are entitled to invoke the doctrine of equivalents, but that it was decided that the range of equivalents depends upon and varies with the degree of invention. See Ives et al. v. Hamilton, Executor, 92 U. S. 426; Hoyt v. Horne, 145 U. S. 302; Deering v. Winona Harvester Works, 155 U. S. 286; Walker on Patents, Sec. 362; Robinson on Patents, Sec. 258."

A careful study of the opinion and record in the Paper Bag case will show that although the Supreme Court did not consider the patent there in issue a pioneer patent, such for instance as the Bell telephone, it did, nevertheless, because of the success achieved by the invention, give the claims a liberal interpretation, commensurate with the degree of the invention actually made, and held that the defendant, by the use of mechanical equivalents, had infringed the patent, and that, too, notwithstanding the fact that the defendant had a patent on its machine.

On April 10, 1909, in the case of Denning Wire & Fence Co. v. American Steel & Wire Co., this court handed down an opinion, reported in 169 Fed. 793, the principles of which, as applied to the facts in the case at bar, are, we respectfully submit, hardly consistent with the opinion of the majority of this court in the case at bar on the question of construction of claims and the doctrine of mechanical equivalents.

Since the defendant in the case at bar is bound by the findings of the court in the Carbide case, as paragraph VIII of the Answer in this case expressly admits (Record 12-13), to quote from said paragraph VIII of the said Answer, "the matters and things found and decreed in said suit against the Union Carbide Company are res adjudicata against this defendant," then it follows: That the invention of claim 4 of the Westinghouse patent is that described by the Court of Appeals in the Carbide case, at page 498 of 117 Fed., and did result in the great practical benefits found by that court and by the Circuit Court in the same case, viz., the increase of the capacity of transformers from 10 kilowatts to 500 kilowatts.

With the above premises, we respectfully submit that we have in the type M transformer, made and sold by the defendant, to quote what the Court of Appeals in the Carbide case defining the invention of that claim: "such an arrangement and separation of parts as would permit the circulation about them of oil, and the means for the retention of said oil within and about said surfaces, whereby the heat from the oil radiated to the surrounding air."

The invention, then, being embodied in the defendant's
793 type M transformer, it is putting only a reasonable amount of vitality into claim 4 and only a reasonable application of the doctrine of mechanical equivalents, and quite within the rule laid down by this court in the case of Owens Company v. Twin City Separator Company, at pages 266 and 267 of 168 Fed., and within the rules governing the interpretation of claims laid down by the United States Supreme Court in the Paper Bag case, 210 U. S. 405, to hold that the defendant's type M transformer infringes said claim 4.

For these reasons we respectfully submit that the majority opinion of this court in the case at bar is in error and in conflict with the decisions of this court and of the Supreme Court of the United States in analogous cases, and that a re-hearing should be granted.

As to the Accounting Feature of This Case.

In regard to this question, after the recitals in the majority opinion of this court, found at pages 7 and 8 of that opinion, the Court states:

"We are unable to concur in the master's findings. We think Claim Four is a limited detailed claim—open spaces in the core being one of its chief or distinguishing features. This was the view entertained by Judge Amidon upon an application for a temporary injunction, and by Judge Adams at the hearing upon which the case was referred to the master."

Even of the court were right in stating that claim 4 is a limited

claim—open spaces in the core being one of its chief features—nevertheless, under the decisions which we have cited, that should not have affected this question as to the admitted form of infringement found in the defendant's infringing transformers accounted for before the Master, for those transformers did have open spaces in their cores, and even if those infringing transformers also had open spaces between the coils and between the coils and the core, that would not have been a departure from the invention of claim 4, as we have already pointed out, not only because the patent, at line 65, etc., shows that Mr. Westinghouse contemplated separating the coils, but also because, as we have already pointed out, the spaces between the coils and the core are quite within the spirit of the invention and its object as defined in the specification between lines 16 and 21, and of the nature of the invention as found by the Court of Appeals in the Carbide case; and the answer, in paragraph IX, (Rec. p. 13) distinctly admits that the defendant "has, since the 12th day of July, 1887, and subsequent to the assignment to the complainant, within the Eastern District of Missouri and elsewhere throughout the United States, made, used and
794 sold devices or apparatus which embody the invention or discovery claimed in claim 4 of said letters patent." It also appears from complainant's proofs on the accounting and from the admissions of Mr. Layman that every one of the infringing transformers accounted for before the Master did embody the construction referred to in the part of the answer above quoted.

As to Judge Adams' opinion referred to in the above extract, we have already discussed that and shown, as we believe, that Judge Adams was wrong. Whether or not Judge Adams was right or wrong in his construction of claim 4 would seem immaterial on this question of the accounting, because Judge Adams himself found by his interlocutory decree entered in this case that in respect to the form of transformer referred to in the defendant's answer, there had been an infringement of claim 4, and ordered an accounting as to these transformers. Furthermore, it would seem, as we have already pointed out, that Judge Adams ignored the binding force and effect on this defendant of the decision in the Carbide case and of the things found in the Carbide case, referred to in a previous part of this petition, notably the pronounced step in advance made by the invention of Mr. Westinghouse in 1887, and the legal effect of the latter in the construction of the claim, and the fact that the Court of Appeals in the Carbide case had defined the invention of claim 4 to be "such an arrangement and separation of parts as would permit the circulation about them of oil, and the means for the retention of said oil within and about said surfaces, whereby the heat from the oil radiated to the surrounding air."

As to Judge Amidon's opinion, which is also found in this record at page 219, we think the majority of this court gave too much weight to that opinion. It must be remembered that it was rendered on a motion to punish the defendant for contempt, and on that motion Judge Amidon was not considering the admittedly infringing structure but the type M transformer. Furthermore, even

as to type M transformer, Judge Amidon's opinion is of little weight, because it was simply rendered at a preliminary stage of the case, on a motion for punishment for contempt, where it is quite common for the court to resolve any doubt in favor of the defendant, where it is a question of a particular form of structure not before the court when the injunction was originally granted; particularly so in view of the fact that contempt proceedings are in the nature of quasi-criminal proceedings. It is quite common for the court in such cases to reserve such questions for final hearing. And Judge Amidon's reference to Judge Kirkpatrick's opinion in the case against the American Transformer Company was purely
795 gratuitous and should have no special weight, for the reasons we have already discussed, and particularly so in view of the fact that in the case against the American Transformer Company there was, and could be, no question of estoppel by reason of anything found or decreed in the Carbide case, as the American Transformer Company was not a party to that case nor in privity with the defendant therein.

Even Judge Amidon on that contempt motion, and solely in respect to the type M transformer, which has nothing to do with the accounting feature of this case, says in his opinion, at page 221 of the record in this case:

"The only question is, whether the device which has been adopted by the defendant, is the mechanical equivalent of the device embraced in the complainant's patent. To determine that question would necessitate a very careful and full investigation of the prior art. I do not think such an investigation can properly be made upon a preliminary hearing, or upon the showing that has been made upon the present case. *Such an investigation is only proper for the final hearing.*" (Italics ours).

Another premise of the opinion of the majority of this court immediately following the first quotation above, and which resulted in the majority of this court concluding that the Master was in error in finding that the entire commercial value of the infringing transformers manufactured and sold by the appellee during the accounting was due to the combination the subject-matter of claim 4, is as follows and is taken from the foot of page 8 and top of page 9 of the majority opinion:

"The evidence clearly shows, we think, that the thing principally to be desired in the construction of a transformer is to keep the coils rather than the core from becoming overheated. The appellant's patent, Claim Four, seems to have proceeded upon the idea that the thing principally to be accomplished was to keep the core from becoming overheated and to that end it provided that one element of the combination covered by Claim Four was to be the open spaces in the core, *nothing whatever being said in that claim about open spaces between the coils or about open spaces between the core and the coils.* Bearing in mind that the thing desired is to prevent the overheating of the coils, it will be seen that appellant's combination, Claim Four, operates to that end only in so far as the core if becoming overheated would have a tendency to heat the coils. The ap-

pellee in our view improved upon appellant's device by providing, in addition to spaces in the core, for spaces between the coils
796 and spaces between the core and the coils, through which the oil or other cooling medium could circulate and thereby much more certainly and efficiently accomplish the purpose desired, viz.: keeping the coils at a proper state of temperature. This, we think, was a material and substantial improvement on appellant's combination, Claim Four." (Italics ours.)

We think we have already shown, and we again repeat, that we believe the majority of this court is very much in error in the above premises which resulted in the court's conclusion above stated. In the first place, this suit is under a patent, and as the said patent was construed by the Court of Appeals in the Carbide case, which decision is admittedly binding on this defendant, said patent is the best and binding evidence in this case as to the nature of that invention. Even admitting, for the sake of argument only, that the most desirable thing is to keep the coils, rather than the core, from becoming overheated, this is at best a mere theory, and there is not only nothing in the patent itself which shows that it is desirable to keep the core rather than the coils from becoming overheated, but there is affirmative evidence in the patent itself that it was most desirable to keep the coils from becoming overheated. The transformer, as pointed out in our main brief before this court, and as the Westinghouse patent itself shows, is composed of a core and primary and secondary coils. In the type of transformer illustrated in the Westinghouse patent as one form of embodiment of the patented invention, in compliance with Section 4888 of R. S. U. S., we have not only open spaces in the core but spaces between the primary and secondary coils, as pointed out in the specification of the patent between lines 61 and 69; and, as we have already shown, it is no departure from that invention, but quite in harmony with it, to have space between the coils and the core. All of these open spaces are obviously within the core and open up the coils and core to the circulation of the oil. Furthermore, even in the form or embodiment of the Westinghouse invention as illustrated in the patent, the inevitable result of having all the spaces in the core and the perforations f^3 f^3 in the tubes, referred to in the specification at lines 69 and 70, as one means of making the spaces in the core and opening up the transformer for the circulation of oil, is to cause the oil to circulate and pass up against and about the primary and secondary coils so as to keep the coils as well as the core from becoming overheated. Also, the specification states, lines 16 to 21:

"The object of this invention is to provide a simple and efficient converter which will not become overheated when employed
797 for a long time in transforming currents of high electromotive force, and which will be thoroughly ventilated."

And the Court of Appeals in construing this very invention of claim 4 in the Carbide case, on the same state of the art as presented before Judge Adams in the case at bar, and which is one of the findings of the Court of Appeals, and therefore binding on the defendant, as admitted by paragraph VIII of the answer, (a thing Judge

Adams seems to have overlooked), states, at page 498 of 117 Fed.:

"In these circumstances, the patentee seems to be entitled to claim the means by which the external and internal surfaces of the heat-producing parts of a converter were cooled by such an arrangement and separation of parts as would permit the circulation about them of oil, and the means for the retention of said oil within and about said surfaces, whereby the heat from the oil radiated to the surrounding air."

Therefore, we respectfully submit, it is clear from the patent itself and from the construction placed upon claim 4 by the Court of Appeals in the Carbide case, that, even if it be theoretically true, or even practically true, that it is principally to be desired to keep the coils rather than the core of the converter from becoming overheated, such a desideratum was contemplated by the patent and by the invention of claim 4; at all events, there is nothing in the patent to the contrary.

Treating the patent fairly and in the light of the success achieved by that invention in 1887, we respectfully submit that the nice distinction which the majority of this court made is not warranted. Furthermore, we respectfully submit that it would be utterly immaterial, even if it were correct, to say that claim 4 says nothing about open spaces between the core and the coils. The claim of a patent is not the place in which to state the advantages growing out of any particular construction. Even in the specification of a patent it is not necessary to state the advantages growing out of the construction described, although it is quite common in specifications to refer more or less to them. The purpose of the specification is to describe one form or embodiment of the invention, and generally the form which the patentee conceives to be the best mode known to him of carrying his invention into effect. But the specification of the patent in this case does specifically refer, between lines 62 and 69, to blocking the groups of plates apart at intervals, and to separating the primary and secondary coils, and it is certainly quite within the spirit of the invention, and indeed almost a natural incident
798 thereto, to have space between the coils and the core. But, as we have already pointed out, the fact is that the Court of Appeals in the Carbide case, which finding is binding on this defendant, found that the invention of claim 4 did not reside in the precise form in which Mr. Westinghouse had embodied his invention and illustrated and described it in his patent to conform with Section 4888 of the Revised Statutes of the United States, and that the following quotation from the decision of the Supreme Court in the case of Winans v. Denmead, at pages 342 and 343 of 15 Howard, and pages 549 and 550 of 20 U. S. Reports, answers, we most respectfully submit, in the light of the facts that we have already alluded to, the second premise stated in the opinion of the majority of this court:

"It is generally true, when a patentee describes a machine, and then claims it as described, that he is understood to intend to claim, and does by law actually cover, not only the precise forms he has described, but all other forms which embody his invention; it being

a familiar rule that, to copy the principle or mode of operation described, is an infringement, although such copy should be totally unlike the original in form or proportions.

Why should not this rule be applied to this case?

It is not sufficient to distinguish this case to say, that here the invention consists in a change of form, and the patentee has claimed one form only.

Patentable improvements in machinery are almost always made by changing some one or more forms of one or more parts, and thereby introducing some mechanical principle or mode of action not previously existing in the machine, and so securing a new or improved result. And, in the numerous cases in which it has been held, that to copy the patentee's mode of operation was an infringement, the infringer had got forms and proportions not described, and not in terms claimed. If it were not so, no question of infringement could arise. If the machine complained of were a copy, in form, of the machine described in the specification, of course it would be at once seen to be an infringement. It could be nothing else. It is only ingenious diversities of form and proportion, presenting the appearance of something unlike the thing patented, which give rise to questions; and the property of inventors would be valueless, if it were enough for the defendant to say, your improvement consisted in a change of form; you describe and claim but one form; I have not taken that, and so have not infringed.

The answer is, my improvement did not consist in a change of form, but in the new employment of principles or powers, in a new mode of operation, embodied in a form by means of which a new or better result is produced; it was this which constituted my
799 invention; this you have copied, changing only the form; and that answer is justly applicable to this patent."

The Court of Appeals in the Carbide case, as before pointed out, held that claim 4 of the Westinghouse patent in suit was not for a particular form of apparatus, but for an invention by means of which the

"external and internal surfaces of the heat-producing parts of a converter were cooled by such an arrangement and separation of parts as would permit the circulation about them of oil, and the means for the retention of said oil within and about said surfaces, whereby the heat from the oil radiated to the surrounding air;"

and that purpose, once disclosed and illustrated, it was an easy thing for the defendant, if it chose to do so, to open up its converter a little more by making spaces, or larger spaces, between the coils and the core, in addition to having the spaces between the coils and the open spaces in the core more specifically referred to in the Westinghouse patent. Although Mr. Westinghouse does describe, in harmony with the spirit of his invention defined by the Court of Appeals, and in harmony with the general purpose of his invention stated between lines 16 and 21, open spaces between the coils, specifically referred to beginning at line 65 of the patent in suit, he did not specifically bring that feature into claim 4, which would have

been simply to add a limitation to claim 4, but he claimed broadly the structure as an entirety, whether or not it had open spaces between the coils and between the coils and the core; having done this he was entitled to invoke the doctrine of equivalents, under the rule laid down by the Supreme Court in the case of Winans v. Denmead, supra, and of this Court in Brake Beam Case, at p. 715 of 106 Fed.

Furthermore, it has been admitted and never denied in this case that all the transformers accounted for before the Master made and sold by the defendant during the years covered by the accounting, embodied in their construction "the invention or discovery covered by claim 4, of the letters patent in suit, as admitted in paragraph IX of the answer (Record, p. 13).

In view of this, we respectfully submit that the majority of this court has erred in the two premises already referred to, as a result of which the majority of the court found that the Master was in error in finding that the entire commercial value of the transformers manufactured and sold by the appellee during the time of the accounting was due to the combination described in claim 4 of the complainant's patent.

800 It therefore follows that the next conclusion of the opinion of the majority of the court, found in the paragraph at the middle of page 9 of the opinion is unwarrated; for, as infringment involves substantial identity, as the invention the subject-matter of claim 4 is, at least as against this defendant and on this record, the invention defined by the Court of Appeals in the Carbide case at page 498 of 117 Fed., the defendant's infringing transformers accounted for before the Master are substantially and essentially identical with the transformer the subject-matter of claim 4. For if the invention of Mr. Westinghouse be the invention found by the Court of Appeals in the Carbide case, so often quoted in this petition for rehearing, then it is manifest that all the infringing transformers accounted for before the Master are substantially and essentially identical with the invention of claim 4. Furthermore, as we have already pointed out, and as a reference to the patent itself will show, there is very little difference, even in form, between the said infringing transformers accounted for before the Master and the particular transformer which Mr. Westinghouse, illustrated in his patent.

Furthermore, as all of these infringing transformers admittedly had open spaces in the core and admittedly infringed claim 4, and as the Circuit Court and Circuit Court of Appeals in the Carbide case found that the invention of claim 4, after it had once gone into general use, practically revolutionized the transformer art, it is manifest from that finding, which is binding on this defendant, and from the entire evidence in this case, that at least as to those several thousand infringing transformers sold during the time covered by the accounting, the defendant found it expedient in view of the demand created by reason of the Westinghouse invention, to make its transformers so that they would embody the invention of claim 4.

The cases cited by the majority of the court at the foot of page 9 of its opinion, in view of the facts to which we have just called attention, are, we respectfully submit, inapplicable to the facts as they exist in this case.

The case of Stirrat et al. v. Excelsior Mfg. Co., 61 Fed. 980, decided by this court (a case in which the writer was counsel for the defendant), had nothing to do with the question of accounting, and in that case this court expressed grave doubt as to the validity of the patent. It was not found in that case that the water-heating device of that patent had increased the capacity of water-heating devices at all, whereas in the case at bar it was found
801 by the Court of Appeals in the Carbide case that the invention here in question increased the capacity of transformers from 10 kilowatts to 500 kilowatts. In the Stirrat case it was found by this court that the complainant's patent, if valid at all, was for practically an infinitesimal improvement on the prior art, and hardly to be distinguished from the prior patented structures, and in that case this court said at page 984 of 61 Fed.:

"If, therefore, the claims of this patent warranted a construction broad enough to cover the device of the appellee, we should have no hesitation in holding it void for want of novelty;"

whereas, in the case at bar, so far as the infringing forms of transformers accounted for before the Master are concerned, said forms of transformers have been found to embody, and admittedly embody the invention the subject-matter of claim 4 of the patent in suit. And the Court of Appeals in the Carbide case, in respect to precisely one of these infringing transformers accounted for before the Master, specifically found that it embodied, substantially and essentially, the valuable invention the subject-matter of claim 4 which the Court of Appeals refers to at page 498 of 117 Fed.

The opinion in the case of Baker v. Crane Co. (mistakenly referred to in the opinion of this court at 130 Fed. 60, but actually reported in 138 Fed. 60), is very brief, and utterly fails to show that the structure of the patent at once went into general use and supplanted devices of the prior art; whereas, in the case at bar, among the premises which the complainant is entitled to rely upon are the things found by the Circuit Court and Circuit Court of Appeals in the Carbide case in respect to this invention, which show that the invention of claim 4 of the Westinghouse patent at once went into general use, and not only supplanted other transformers but was in fact the first converter of that type, resulting in increasing the capacity of the converter from 10 kilowatts to 500 kilowatts, and not merely an attachment for a car-heating apparatus as in the case of Baker v. Crane Co.

The case of Blake v. Robertson or Robertson v. Blake, 94 U. S. 728, had nothing to do with the question of recovering defendant's profits but had to do simply with recovering damages. We pointed out in our main brief before this court (see p. 57 thereof) the difference between damages and profits. Damages recoverable in equity are the damages which the plaintiff has suffered, as in a case where the complainant grants licenses under his patent, and there-

fore may sometimes be the profits which the complainant
2 would have made but for the infringement; but profits re-
coverable in equity, strictly speaking, are the profits which
defendant has made, or which, under all the evidence, the court
justified in estimating. Furthermore, it is fundamental that
mages recoverable on an accounting are not to be estimated but
ually proved, whereas the defendant's profits may be estimated.
show that that decision has absolutely no application to the case
bar, we quote all that the Supreme Court says on that subject
ich is found at pages 733 and 734 of 94 U. S.:

"It remains to consider the question of damages. A few remarks
on that subject will be sufficient.

The proof is meagre and indefinite.

The infringers made but four machines.

No license fee charged by the complainant is shown. The burden
proof rests upon him. Damages must be proved; they are not to
presumed. The complainant made a profit of forty dollars an
ch on the width of the jaws of the numerous machines he had
ld.

But inventions covered by other patents were embraced in those
achines. It was not shown how much of the profit was due to
ose other patents, nor how much of it was manufacturer's profit.
he complainant was, therefore, entitled only to nominal damages.
his the court gave him. It was all the state of the evidence war-
nted. It would have been error to give more."

Cases as to damages and cases as to profits should not be con-
sed; for the rules as to recovery are different. Profits can only
recovered in equity. The case at bar has only to do with profits.
The case of Garretson v. Clark, 111 U. S. 120, is another case
ferred to by the majority of this court at the foot of page 9 of
s opinion, and is a very much misunderstood case, the history
which we tried to give in our brief before this court, and we
ost respectfully but earnestly ask the court to refer to our original
ief before this court in regard to that case of Garretson v. Clark
we discuss the same between pages 114 and 118 of that brief.
he opinion of the Supreme Court in Garretson v. Clark is quite
ief, as we pointed out at page 116 of our original brief before this
urt. The early history of that case is found in 15 Blatchford,
d. Cas. 5248. It will be found that the patent there at issue
as not on the entire mop head but only on certain details of con-
struction of the mop head. The Master allowed all the
03 profits on the mop head, as a whole, notwithstanding the
fact that the patent was only for certain details—a certain
ature of construction—of the mop head. There was nothing in
he case of Garretson v. Clark which makes that case applicable to
he case at bar, as the facts in that case were totally different from
he facts in the case at bar. We show this in our original brief (p.
17 thereof) by reference to the opinion of the Supreme Court in
Hurlbut v. Schillinger, 130 U. S. 472, where the patent, like the
Westinghouse patent in the case at bar, was not only for a most
aluable invention that had gone into general use but was on the

construction of a pavement as an entirety. The distinction which we make between the case at bar and the case of Garretson v. Clark was recognized by the Court of Appeals for the Sixth Circuit in the case of P. P. Mast & Co. v. Superior Drill Co., 154 Fed. 45, referred to in our original brief in this case at page 115 thereof; and the very distinction which we make between the case at bar and the case of Garretson v. Clark is recognized and applied by the unanimous opinion of the Court of Appeals for the Sixth Circuit in the case of Yesbera v. Hardesty Mfg. Co., 166 Fed. 120, decided December 23, 1908.

Not only is the case of Garretson v. Clark utterly indifferent from the case at bar, but the claim of the patent there in suit was not for the structure as an entirety, and the invention was not found to be a valuable contribution to the art, and was not found to be an invention of the character of the invention of claim 4 of the Westinghouse patent as pointed out by the Court of Appeals in the Carbide case.

On page 8 the majority opinion says:

"The evidence clearly shows, we think, that the thing principally to be desired in the construction of a transformer is to keep the coils rather than the core from becoming overheated. * * * Bearing in mind that the thing desired is to prevent the overheating of the coils, it will be seen that appellant's combination, Claim Four, operates to that end only in so far as the core if becoming overheated would have a tendency to heat the coils." * * * "It must, of course, be conceded that while appellant's combination, Claim Four, although really designed to keep the core from becoming overheated, also tended to keep the coils from becoming overheated, but appellee's transformer much more efficiently accomplished the result desired by providing for a circulation of oil or other cooling medium through the open spaces between the coils and between the coils and core, as well as through the open spaces in the core."

804 The majority of the court therefore concludes that the Master was in error in giving appellant the entire profits of appellee.

In reply to this finding, we submit that it is erroneous for the following reasons, viz:—

1. The only evidence on the subject is not that of defendant's practical experts, but of its theoretical expert, Nipher (Transcript, p. 566), where he says:

"There is a distinct advantage in having the iron core warm, so long as the copper coils are cool. This diminishes the iron loss and the cooling of the copper coils diminishes the copper loss."

He supports this statement by reference to two patents, 516,850 to Thomson and 539,876 to Moody, but these patents were dealing with an old problem, viz: the relative variation of iron and copper losses, which is practicable within only narrow limits, and cannot disregard the broader question of the disposal of the internal heat developed in converters of large size and dealing with large currents. Westinghouse, abandoning former attempts to prevent the develop-

ent of heat, which imposed an effectual barrier to the progress of
e art, faced the other way and devoted his attention to disposing
the internal heat, regardless of its quantity and of the size of
e converter. His solution of this problem was such as effectually
moved the barrier and enabled converters to be made up to 500
ilowatts capacity, whereas before 10 kilowatts was the limit. Pro-
ortioning the loss between the iron and copper is relatively as much
dvantage in large sizes as in small, but under no circumstances can
e core be run hot, because then it would not only age and thereby
eteriorate rapidly and destructively increase the iron losses, but
ould also heat the coils, and thereby increase the copper losses and
estroy the insulation.

No other witness makes this assertion, and moreover it is a prin-
iple of narrow, not general application, as Nipher seems to imply,
nd as the majority of the court apparently gathered from the
anner of his statement of the same.

2. The statement of the majority opinion in this connection on
age 8, that

"The appellant's patent, Claim Four, seems to have proceeded
pon the idea that the thing principally to be accomplished was to
eep the core from becoming overheated,"

nds no express warrant in the specification. It is not once men-
tioned or hinted at. On the contrary the whole tenor of the
605 document shows, we submit, that Westinghouse was dealing
with the broader problem of (to use the language of the
Court of Appeals in the Carbide case) "means by which the external
nd internal surfaces of the heat producing parts of a converter were
ooled by such an arrangement and separation of parts as would
ermit the circulation about them of oil, and the means for the
etention of said oil within and about said surfaces, whereby the heat
rom the oil radiated to the surrounding air."

To this end he separated the coils where they passed through
he center of the core by blocks or perforated tubes f^2, so as form
n open space between them through the interior of the core, and
e separated the core plates in groups and blocked the groups apart
r separated them by perforated tubes f^1, so as to form open spaces
etween them. This formed openings at intervals along three sides
f the coils through which the oil circulated against them, while
he central opening between the coils permitted the free circulation
f the oil along their adjacent or inner sides.

The specification describes the operation as follows (lines 79-82):
The oil "circulates through the tubes and the intervening spaces
of the coils and plates, and preserves the insulation, excludes the
moisture, and cools the converter."

It seems to us that the specification affords no warrant for the
conclusion that the inventor proceeded upon the idea that the thing
principally to be accomplished was to keep the core, as distinguished
from the coils, from becoming overheated. He sought to preserve
the insulation, exclude the moisture and cool the converter. This
is his own statement. And he says he did this by the circulation

of the oil "through the tubes and the intervening spaces of the coils and plates."

Now read the claims in the view of these statements. All of the claims call for open spaces, but claims 1, 2, 3, and 5 are limited to the preferred construction described in the patent. Thus claim 1 calls for an open space between the coils, claim 2 calls for open spaces between the groups of core plates, claim 3 calls for open tubes between the groups, and claim 5 for air spaces between the groups. All of these open spaces are "in" or, as appellee's brief defines the word (Appellee's Brief, page 49), "within the bounds or limits of the core.

Claim 4 does not use terms descriptive of any of these open spaces. If the patentee had intended to limit this claim to
806 open spaces constructed in the material or solid parts of the core, he could have used appropriate terms, such for instance as in claim 2. But he used a new expression, not before used in the patent, viz., "in its core," which considering that the core was a thick iron structure completely enclosing the coils, that the dangerous accumulation of heat was within the same, and that all the open spaces that the patentee had described, however formed, were enclosed by or within the bounds or limits thereof, was evidently regarded as a generic or broad expression and intended to cover broadly the various open spaces described in the specification.

It should be remembered that the claim does not call for a core constructed with open spaces in it, but "an electric converter constructed with open spaces," said spaces being located in its core. Now such a converter can be constructed with a solid core as well as with an open-work core. It may be constructed as in defendant's type M, with open spaces between the coils and between the coils and adjacent sides of the core. But when constructed these open spaces are clearly located in or "within the bounds or limits of" the core. The claim, therefore, uses terms capable of a broad construction inclusive of an open space through the core of the constructed converter, and as it is for a primary improvement, marking a distinct advance in the art, such construction should be accorded to it.

3. The evidence of Nipher is inconsistent with, indeed contradictory, of defendant's own assertions made in the thousands of catalogues issued by it prior to the beginning of the suit. At pages 14-15 of our brief on appeal we point out these statements from defendant's catalogues, showing that it then insisted on the greater importance of the iron loss and consequently greater importance of cooling the core. In view of these statements we do not think that such weight should be given to the unsupported and misleading statement of Nipher as to relative advantage of cooling the core and the coils, and that the finding as to supposed advantage of the defendant's transformer over complainant's, which formed the grounds for sustaining the award on nominal damages, was based on insufficient evidence.

The evidence with regard to the performance of the trial transformers we do not regard as material on this point, for such trans-

formers were merely infringing transformers, containing the equivalent open spaces.

807 Another proposition stated in the majority opinion of this court and manifestly affecting its conclusions as to the accounting feature of this case is thus stated at page 9 of the printed opinion:

"And to the extent that the appellee has improved upon that which was covered by appellant's patent, Claim Four, the appellant cannot demand the appellee's profits, because the only right of the appellant to complain of the appellee is in the use by the appellee of the patented combination, Claim Four, and the only right which the appellant has to profits realized by the appellee is confined to such profits as resulted solely from the use of appellant's combination, Claim Four, the profits resulting from the improvement made by the appellee being something in which the appellant has no interest."

In the first place, as we think we have just shown, the infringing transformers accounted for are substantially and essentially the same thing as the transformer of claim 4, even if it be true that the infringing transformers embodied, in addition to open spaces in the core, spaces between the coils (a thing which the Westinghouse patent describes, line 65, etc.) and spaces between the coils and the core, the latter feature being the equivalent of and no departure from the invention the subject-matter of claim 4, especially as the same is defined by the court in the Carbide case at page 498 of 117 Fed. supra.

Furthermore, it would have been impossible to measure the difference between the profits due to claim 4 (admittedly infringed by those infringing transformers accounted for) and the profits due to opening up the transformer a little more by placing spacing strips between the core and the coils and also spacing strips between the sections of the core (the latter feature being present in all the infringing transformers and being also specifically shown and described in the patent in suit). For, apart from the fact that even in the particular form of the embodiment of the invention described in the patent in suit, it is inevitable to have some little space between the coils and the core, between which the oil must seep. To make those spaces a little larger (even if defendant did do that in all its infringing transformers accounted for, which we do not believe is true), would only have affected in degree the circulation of oil in and between the parts of the transformer which were liable to become overheated. But what is rather important here is that Judge Adams, in his opinion in regard to the type M transformer, at page 607 of 129 Fed. distinctly states and finds on the evidence before him that in the defendant's construction, so far as the spaces between the inner surfaces of the core and the outer surfaces of the coils are

808 concerned, they resulted in "decreasing the efficiency of its transforming action." In other words, Judge Adams found in the Circuit Court that the particular feature which the majority of this court finds resulted in an improvement in the defendant's infringing transformers accounted for before the Master, was a distinct detriment to the transformers. This, we think, of itself is enough to show not only that there was no real advantage in that

feature present in the defendant's transformer, but that, if anything, under the findings in this case, it was a distinct disadvantage "decreasing the efficiency of its transforming action."

Besides, if it were true (a thing which we do not admit) that in defendant's infringing transformers accounted for, all of them had open spaces between the coils and the core, besides the combination claimed and shown in the patent in suit, (admittedly all of defendant's infringing transformers had present in their construction the subject-matter of claim 4 of the patent in suit), and also spaces between the coils (a thing which the patent in suit expressly contemplates), then the burden of proof was shifted to the defendant to show what profits made on those infringing transformers were due to that feature of having the spaces between the coils and the core (a feature which Judge Adams says at page 607 of 129 Fed. is a distinct detriment to the defendant's transformers). See Elizabeth vs. Pavement Co., 97 U. S. 141. That, under the circumstances, the burden was shifted on the defendant to show that the feature of having distinct spaces between the coils affected the question of the profits made by the defendant on the infringing transformers accounted for before the Master, see Brennan & Co. v. Dowagiac Mfg. Co., and the following language of the Court of Appeals in that case taken from pages 476 and 477 of 162 Fed.:

"In the present case the infringer's conduct has been such as to preclude the belief that it has derived no advantage from the use of the plaintiff's invention, as the Master well said. In these circumstances, upon whom is the burden of loss to fall? We think the law answers this question by declaring that it shall rest upon the wrongdoer, who has so confused his own with that of another that neither can be distinguished. It is a bitter response for the Court to say to the innocent party: 'You have failed to make the necessary proof to enable us to decide how much of these profits are your own;' for the party knows, and the Court must see, that such a requirement is impossible to be complied with. The proper remedy to be applied in such cases is that stated by Chancellor Kent in Hart v. Ten Eyck, 2 Johns. Ch. (N. Y.) 62, 108, where he said:

869 'The rule of law and equity is strict and severe on such occasion. If a party having charge of the property of others so confounds it with his own that the line of distinction cannot be traced, all the inconveniences of the confusion is thrown upon the party who produces it, and it is for him to distinguish his own property or lose it.'

This, also, was a case of an accounting by a trustee. And in a proceeding against an infringer for profits, the defendant may not inaptly be regarded as a trustee de son tort. Wales v. Waterbury, infra. And see, also, Wylie v. Ellice, 6 Hare 505; Bailey v. Bailey, 67 Vt. 494, 32 Atl. 470, 48 Am. St. Rep. 826. As was said on a former occasion, the obligation cast on the party causing the confusion cannot be less when, instead of being intrusted with the possession of property, he takes possession of it wrongfully. P. P. Mast & Co. v. Superior Drill Co., 154 Fed. 45, 57, 83 C. C. A. 157. The rule is of general application. It is stated with equal emphasis by

Mr. Justice Strong in The Idaho, 93 U. S. 575, 586, 23 L. Ed. 978, where Hart v. Ten Eyck was cited as authority for it. In Wales v. Waterbury, 101 Fed. 126, 41 C. C. A. 250, it was invoked by the Court of Appeals for the Second Circuit as applicable to the accounting for profits in a patent cause, as it was also by this court in the above cited cause of P. P. Mass & Co. v. Superior Drill Co. The rule has been recognized by this court in several cases, among them Smith v. Township of Au Gres, 150 Fed. 257, 80 C. C. A. 145, 9 L. R. A. (N. S.) 876, and Smith v. Mottley, 150 Fed. 266, 80 C. C. A. 154, in which last case we referred to a number of cases in other jurisdictions as well as our own."

See also the cases cited and quoted from at pages 132 and 133 of our original brief before this court.

Furthermore, it is not a correct principle of law to say, in a case where the complainant's patent is for a combination as an entirety and for the structure as an entirety, that the defendant who has used that invention as an entirety in his infringing transformers, even if he as improved thereon, is entitled to a separation of the profits due to his improvement present in the infringing structures accounted for. In the case of Hurlbut v. Schillinger, 130 U. S. 472, the defendant while using the complainant's invention as an entirety in its pavement did not use the exact form of the embodiment shown in the complainant's patent, and claimed to have used an improvement thereon; nevertheless, the Supreme Court, as pointed out at page 136 of our main brief, in that case (130 U. S. 472) granted the complainant the entire profits made by the defendant in the manufacture and sale of its infringing pavements. See also the case of Crosby Valve Co. v. Safety Valve Co., 141 U. S. 441, where the claim of complainant's patent was for a new combination of old ele-
810 ments, the actually new feature in the combination, which resulted in the new structure as an entirety, being the annular flange. Nevertheless, the fact that the defendant embodied this same invention in a different form and had a patent for its improvement (the defendant in the case at bar has no patent on the infringing transformers accounted for before the Master any more than it has on its type M transformer), did not prevent the Supreme Court from giving the plaintiff all the profits made by the defendant in the manufacture and sale of the infringing valve, notwithstanding the improvements of the Crosby patent which were embodied in the infringing valves.

Furthermore, it is well settled and specially decided by the Supreme Court of the United States in the case of Tilghman v. Proctor, 125 U. S. 136, 146, that in the matter of determining profits the comparison is not made between anything, even if it be an improvement, which comes after the date of the patent in suit but between the patent in suit and prior structures. The evidence in this case is, as the Circuit Court of Appeals found in Carbide case, that there was nothing in the prior art that affected the Westinghouse invention the subject-matter of claim 4, and that Westinghouse by that invention had made an improvement over the prior art which resulted in increasing the capacity of transformers from 10 kilowatts to 500 kilo-

watts. Furthermore, the record shows that if there was any novelty or advantage in opening up the transformer to a greater degree by placing spaces between the coils and the core, and otherwise using the combination of claim 4 of the patent in suit, such an arrangement, if not clearly within the spirit of its patented invention, came after the patent in suit and not before it, leaving out of consideration the fact that Judge Adams in the Circuit Court, as we have already pointed out, decided that by making the spaces between the coils and the core that was done at the expense of the efficiency of the transformer.

In Turrill v. Illinois Central R. Co., 20 Fed. 914, Mr. Justice Harlan of the Supreme Court, in harmony with the similar decision of the Supreme Court in the case of Crosby vs. Valve Co., 141, U. S. 441, holds that even if the defendant has a patent for an alleged improvement on the structure which infringes complainant's patent, and even if it be true that by the use of the defendant's structure better results are accomplished, nevertheless the complainant is entitled to recover from the defendant all of the profits that the defendant made by using the complainant's structure, even in defendant's improved machine.

811 This court further says in its majority opinion, following the quotation which we have just considered, as follows:

"The evidence shows, we think, that the open spaces between the coils and between the core and the coils performed a very substantial office and that if added to spaces in the core would, as already suggested, necessarily accomplish the desired result more certainly and more efficiently."

What we have already said we believe completely meets this proposition of the majority of this court. At best, it was only a change in degree not affecting the substantial identity between the infringing transformers and the transformer of the complainant's patent, it being merely the mechanical equivalent of the transformer of complainant's patent. Furthermore, as we have already pointed out, open spaces between the coils is a feature specifically illustrated and referred to in the patent in suit, beginning at line 65, to say nothing of the fact that Judge Adams distinctly found (page 607 of 129 Fed.) that to have spaces between the core and the coils decreased the efficiency of the transformer.

Following the last quotation from the opinion of the majority of the court we find the following at page 10 of that opinion:

"The Master found that the appellee kept no separate account of its profits realized from its infringing device, but on the contrary, that the profits made by appellee on the infringing transformers were merged with the profits of its entire business, so that it was impossible to separate them and that the appellee did not know and could not furnish the cost of the manufacture of the infringing transformers or even an estimate thereof. We do not think the mere failure to keep separate the profits derived from the infringing device under the circumstances disclosed by the record, warrants the application of the equity rule, that where one wrongfully mingles his goods with those of another so that they are indistinguishable from the mass,

the party injured is entitled to take the whole. This rule has been applied in cases of the invasion of a copyright where the wrongdoer has mingled in the book, matter to which a copyright does not properly extend with matter covered by the copyright, 'the two necessarily going together, when the volume is sold as a unit, and it being impossible to separate the profits on the one from the profits on the other and the lawful matter being useless without the unlawful.' Callaghan v. Myers, 128 U. S. 617."

Taking the last sentence of this proposition, we respectfully submit that there is, under the facts in this case, a very close analogy between Callaghan v. Myers and the case at bar. Callaghan v. Myers, although a copyright case, is one repeatedly referred to by
812 the Supreme Court and other courts on the question of accounting of profits in patent causes, and there is a very close analogy between that case and the case at bar. In Callaghan v. Myers, 128 U. S. 617, the infringing books contained, in addition to the copyrighted matter, some other matter, and it was impossible to show that the profits were due to the printed matter in the book which was not in the copyrighted book; but this confusion was all of the defendant's making, and therefore the court applied the rule set forth in the case of Wales v. Waterbury, 101 Fed. 129; in these words:

"An infringer is a trustee ex maleficio for the owner of the exclusive rights protected by the patent; and a trustee who has confused the profits made by the use of the trust property with those made from his own property, and commingled them so that they cannot be segregated, must account for the whole. Lupton v. White, 15 Ves. 432; Hart v. Ten Eyck, 2 Johns. Ch. 108; Central Nat. Bank v. Connecticut Mut. Life Ins. Co., 104 U. S. 54."

And so, in the case at bar, the defendant kept no account and could not tell us the difference between profits which it made on those infringing transformers by reason of that feature, but on the contrary all those profits were commingled with the general profits made on the sale of those infringing transformers. At all events, the burden of proof was on the defendant to show that a portion of its profits on its infringing transformers were due to that feature, and the defendant has not shown that any of its profits made on the infringing transformers were due to the feature of having spaces between the core and the coils, even if it be true, as we do not admit, that defendant's infringing transformers were so constructed. (See Elizabeth v. Pavement Co., 97 U. S. 141). On the contrary, we firmly believe that a reconsideration of this question, in view of the facts called to the attention of the court, will show the majority of the court that there is a very close analogy in facts, and principle, between the doctrine of Callaghan v. Myers, 128 U. S. 617, and the case at bar.

We think we have abundantly shown, even if the defendant's infringing transformers accounted for did have open spaces between the coils and the core, that that was not an improvement on the invention claimed by Mr. Westinghouse and nothing more than an extended application of the fundamental principle underlying the

Westinghouse invention. Furthermore, as Judge Adams found in this case at page 607 of 129 Fed., and in this record at page 714, such a construction resulted in decreasing the efficiency of the transformer. But the Supreme Court has expressly decided in the
813 case of Elizabeth v. Pavement Co., 97 U. S., 141, that where, as in the case at bar, the patent is for a complete thing, consisting of a certain combination of elements, and the defendant has used that combination—the whole thing—even if the defendant has used an improvement covered by a later patent, the complainant is entitled to recover the entire profits, and that the burden of showing that such later patented improvement contributed to the profits realized is not on the complainant but on the defendant. In the case at bar, not only was there no real improvement present in the defendant's infringing transformers to the extent that the same may have had open spaces between the coils and the core, but there was no patent on that feature, and the defendant consequently paid nothing for using the alleged improvement, which alleged improvement Judge Adams found not to be an improvement but a detriment; and the defendant, as pointed out by the Supreme Court in Elizabeth v. Pavement Co., 97 U. S. 141, "failed to show that such addition contributed to the profits realized" on the infringing transformers accounted for, which embodied the invention of claim 4 of the patent in suit as an entirety and were sold as an entirety.

We find no warrant in the case of Seymour et al. v. McCormick (cited by the majority of this court at page 10 of its opinion as being found at page 479 of 57 U. S., but which we find reported in 16 Howard, 485) for the proposition that "mere failure on the part of the appellee to keep an account separating the profits prior to the sustaining of appellant's patent and at a time when, as the record shows, appellee believed in good faith that it was not invading any right of the appellant, is not conduct which would render the appellee liable as a confuser of goods," etc.

In the first place, as appears in the opinion in the case of Seymour v. McCormick, 16 Howard, 485, the question there was one of the complainant recovering damages as distinguished from the profits made by the infringement.

In the next place, the fact is, as pointed out by the Court of Appeals in the case of Yesbera v. Hardesty Mfg. Co., 166 Fed. 125, and as pointed out in our brief before this court, the case of Seymour v. McCormick is not at all parallel with the case at bar, because in that case the patent was simply for the driver's seat of a reaping machine and not for the machine as an entirety.

In the third place, the defendant in the case of Seymour v. McCormick, as pointed out by the Supreme Court at page 489 of 16 Howard, claimed to be acting in good faith in respect to the infringement, claiming "under a junior patent." No such
814 condition exists in the case at bar. On the contrary, the defendant in this case committed the infringement, in respect to the transformers accounted for, deliberately and with full knowledge of complainant's patent, and at its own risk.

In the fourth place, the question of the accountability of the

defendant as a trustee, where infringement has been found, is not applicable to a case where damages are sought but where it is a question of recovering the profits made by reason of the infringement, as in the case at bar. In the case of Seymour v. McCormick, 16 Howard, 489, the court is there discussing the question of damages, and the question of treble damages, which are only recoverable where there is the clearest kind of proof of deliberate and wanton infringement.

For these reasons we respectfully submit that the proposition stated by the majority of this court at page 10 of its opinion, applied to the facts in this case and to the question of the recovery of defendant's profits, is not supported by the case of Seymour v. McCormick.

Nor do we find that the case of Keystone v. Adams, 151 U. S. 139, cited by the majority of this court at page 10 of its opinion, is applicable to the case at bar. It appears from the opinion of the Supreme Court at page 146 of 151 U. S. that in that case the defendant sought to obtain profits, not the profits estimated as having been realized by the defendant, but based on the amount of profits which the plaintiff claimed to have shown by evidence that certain third parties made from the sale of similar devices. Although the court did make some general statements there in regard to particular cases, which statements are applicable to those particular cases, but not to the case at bar, it concluded its opinion as follows at pages 148 and 149 of 151 U. S.:

"In the light of these decisions there was error in the court below, not in any formal disregard of the rule restricting the plaintiff's recovery to the profits actually realized, but in permitting the plaintiff to prove, not the defendant's profits, but those realized by other companies. This was in effect showing what, in the opinion of the master and the court, 'he might reasonably have made, and not those which he did make.'

"The fallacy of this application of the rule is obvious, for nothing is more common than for one manufacturing concern to make profits where another, with equal advantages, operates at a loss.

"The learned judge seems to have thought that the course of the defendant, in not itself disclosing the condition of its
815 business, justified the master in estimating its profits upon the basis of those of other similar establishments. But, as we have seen, the burden of proof was upon the plaintiff. He relied, notwithstanding defendant's objections, on incompetent and irrelevant evidence, and the decree in his favor, in so far as it awards more than nominal damages, cannot be sustained."

But in the case at bar it was established by the decisions in the Carbide case, and by the facts in this case, that the invention of claim 4 is for a thing as an entirety and that the merit of the invention was due to that entirety; and the Master in estimating the profits did not estimate them on what any third pary might have made, or even on what the complainant made on its transformer, but on what, from the evidence before him, the Master was satisfied were the reasonable profits made by the defendant in the sale of its infringing transformers.

We understand that all the matter beginning with the last paragraph of page 10 of the majority opinion of the court and ending with the last complete paragraph on page 11 of the opinion is quoted from the decisions of the Supreme Court in the case of Keystone Mfg. Co. v. Adams, and taken from pages 146, 147 and 148 of 151 U. S.; but we respectfully submit that it is not applicable to the facts in this case, for the reasons already stated and because of the point actually decided by the Supreme Court in the case of Keystone Mfg. Co. v. Adams, found in the latter part of page 148 and top of page 149 of 151 U. S., from which we have quoted above.

The majority opinion of this court, so far as the question of this accounting is concerned, concludes as follows:

"Here the appellant failed to prove by reliable or tangible evidence that the entire value of the infringing transformer as a marketable article was properly and legally attributable to appellant's patented combination embodied therein, and so, in the light of the decisions above cited, and many others which we have examined, announcing the same rule, we think that the appellant is entitled to recover nominal damages only; in other words, that as part only of the profits made by the appellee are attributable to the appellant's combination, the balance being attributable to the presence in the infringing device of elements not included in that combination, and as the appellant failed to make proof of how much of the total profits was due to the presence of its combination in the infringing device, there is nothing upon which more than a nominal recovery could be grounded."

The error made by the majority of this court in these
816 conclusions, has, at least we believe, been already pointed out in connection with the discussion of the premises upon which the court based these conclusions. This court, as did Judge Dyer in his opinion in the court below, on the question of this accounting, seems to have overlooked entirely the things found by the Circuit Court and Court of Appeals in the Carbide case as to the nature of the invention of claim 4, and the fact that these findings are admittedly binding on this defendant; and that these findings show, as indeed the patent itself shows, that the invention of claim 4, which the Answer expressly admits is embodied in these infringing transformers (see paragraph IX of Answer, page 13 of Record), is a new and valuable transformer as an entirety, which at the date of the invention of the patent in suit practically revolutionized the transformer art, to the extent that by reason of that invention transformers could be increased in capacity from 10 kilowatts to 500 kilowatts, and that therefore it stood established on the record in this case, even in advance of taking the formal proofs before the Master, and as a part of the record to be considered by the Master and by the court, that the entire value of the infringing transformers as marketable articles is properly and legally attributable to appellant's combination embodied therein. It also is established on the record in this case that the infringing transformers, if they had open spaces between the coils in addition to the open spaces in the core, only had (as to spaces between the

coils) what was specifically referred to and pointed out in the patent in suit at page 65 of the specification of the said patent; and that even if these infringing transformers did also have spaces between the coils and the core that was no departure, in principle, from the invention of the patent in suit and came clearly within the ambit of that invention as defined by the Court of Appeals in the Carbide case at page 498 of 117 Fed. as follows:

"In these circumstances, the patentee seems to be entitled to claim the means by which the external and internal surfaces of the heat-producing parts of a converter were cooled by such an arrangement and separation of parts as would permit the circulation about them of oil, and the means for the retention of said oil within and about said surfaces, whereby the heat from the oil radiated to the surrounding air."

Furtherfore, even if it be true that it was an improvement present in the defendant's infringing transformers accounted for to have open space between the coils and the core (a thing which Judge Adams says in his opinion in this case, see Record p. 714 of 129 Fed. 607, referring to the type M transformer, resulted
817 in decreasing the efficiency of the transforming action), then all we have to say is that under the doctrine of Elizabeth v. Pavement Co., 97 U. S. 141, the burden of proof was not on the complainant to show what profits were due to this modification of the fundamental idea of the invention the subject-matter of claim 4 of the Westinghouse patent (if it were any modification of that fundamental idea), but the burden of proof was on the defendant to do this. Clearly, such a separation of profits would have been impossible and purely imaginary, and clearly the defendant did not show any such separation of profits; but in any event, as pointed out by the Supreme Court in Elizabeth v. Pavement Co., 97 U. S. 141, the burden which the majority of this court seems to think rests upon the complainant in this respect actually rested on the defendant. It was not sufficient for the defendant to show a purely imaginary, theoretical or even practical advantage in having open spaces between the coils and the core, but, as affecting the question of its profits, it was incumbent upon the defendant to show what portion of its profits were due to that modification in form (if it really were a modification in form) over and above the form of the embodiment of the invention as illustrated and described in the patent in suit.

Furthermore, we respectfully submit that the record in this case, starting with the decisions in the Carbide case, which are binding on this defendant, shows that in the light of the art as it existed in 1887, when the patent in suit was granted, the invention of claim 4 of the Westinghouse patent was a distinct step in the progress of the art of electrology, enabling the capacity of converters to be increased from 10 kilowatts to 500 kilowatts, and that the Court of Appeals also found in that case that the invention the subject-matter of claim 4 was as follows:

"such an arrangement and separation of parts as would permit the circulation about them of oil, and the means for the retention of

said oil within and about said surfaces, whereby the heat from the oil radiated to the surrounding air."

It might possibly be that in the present advanced condition of the transformer art that invention now is not of the same value that it was at the time of the patent or during the time of the infringement accounted for before the Master, although we do not admit that this is true. The Circuit Court and the Circuit Court of Appeals find that the value of this invention was at once recognized, and that a demand was created for transformers embodying the invention of claim 4, which the Court of Appeals defined at page 498 of 117 Fed. It is therefore sufficient to know that the
818 defendant, during the period covered by the accounting, deliberately appropriated that invention, and that all of its infringing transformers embodied that invention as admitted by the Answer (paragraph IX) and by Mr. Layman in complainant's testimony-in-chief before the Master. The defendant thus got the benefit of the profits from that invention, during the period covered by the accounting, and consequently, and under the facts found by the Master, should pay to the complainant those profits estimated by the Master on reasonable and proper data presented before him. We hope that in this connection the court will also consider what we say in our original brief before this court and the cases there cited in regard to estimating profits on data supplied to the Master and the authorities which support that proposition, and we most earnestly and respectfully ask that in considering this petition for rehearing this court will also carefully read the recent decision of the Court of Appeals in the case of Yesbera v. Hardesty Mfg. Co., 166 Fed. 120, which supports our contention in so many respects.

We also respectfully submit that, in granting the rehearing and granting the complainant the recovery in this case of the profits estimated by the Master, the court allow the complainant interest from the date of the Master's report, in conformity with the comparatively recent case of Rose v. Hirsh et al., 94 Fed. 177, and the case of Tilghman v. Proctor, 125 U. S. 161.

The majority of the court follows the last-recited quotation from its opinion with the following sentence, found at page 19 of its opinion:

"There is no evidence tending to show that the appellant's failure to show how much of the appellee's profit resulted from the infringed combination and how much from the presence of the other elements of the infringing transformer, was due to any refractory or deceitful conduct on the part of the appellee, such as destruction or hiding of the books, or refusal to produce them for the use of the appellant."

In the first place, we respectfully submit that due weight has hardly been given to the findings of the Master in this respect. The Master took all the testimony, and many things which passed at the hearing before the Master could not be put down on the record. The Master saw the witnesses, noticed their manners and behavior on the stand, the hesitancy of some of defendant's witnesses in answering questions, and the whole attitude of the defendant and its offi-

ers toward this accounting. All these facts were not before the Appellate Court, or before the Circuit Court, which courts simply had nothing before them but the cold record. In regard
819 to the weight to be attached to the Master's report, we respectfully call this court's attention to the following:

"The conclusions of the Master, depending upon the weighing of conflicting testimony, have every reasonable presumption in their favor, and are not to be set aside or modified unless there clearly appears to have been error or mistake on his part. Tillghman v. Proctor, 125 U. S. 136, 149, 8 Sup. Ct. Rep. 894; Callaghan v. Myers, 128 U. S. 617, 666, 9 Sup. Ct. Rep. 177; Kimberly v. Arms, 129 U. S. 512, 525, 9 Sup. Ct. Rep. 355; Central T. Co. v. Texas R. Co., 32 Fed. Rep. 448; Welling v. La Bau, 34 Fed. Rep. 41, and cases cited."

As to the weight which should be given to the Master's report in such a case as this, the Supreme Court says in Tilghman v. Proctor, 125 U. S. 149-150.

"We are then brought to a consideration of the exceptions taken to the Master's report in matters of fact, affecting the accuracy of his conclusions in respect to the amount of those profits, gains and savings. In dealing with these exceptions, the conclusions of the Master, depending upon the weighing of conflicting testimony, have every reasonable presumption in their favor, and are not to be set aside or modified unless there clearly appears to have been error or mistake on his part. Medsker v. Bonebrake, 108 U. S. 66; Donnell v. Columbian Ins. Co., 2 Sumner 366, 371; Mason v. Crosby, 3 Woodb. & Min. 258, 259; Paddock v. Commercial Ins. Co., 104 Mass. 521, 531; Richards v. Todd, 127 Mass. 167, 172."

In Crawford v. Neal, 144 U. S. 585, the Supreme Court holds as follows:

"The findings and conclusions of a Master upon conflicting testimony are to be taken as presumptively correct, and unless some obvious error in the application of the law has intervened, or some serious or important mistake has been made in the consideration of the evidence the decree should stand."

To the same effect is Furrer v. Ferris (opinion by Mr. Justice Brewer), 145 U. S. 132, citing Kimberly v. Arms, 129 U. S. 512, and Evans v. State Bank, 141 U. S. 107.

See also Warren v. Keep, 155 U. S. 265.

But we believe that the majority of the court is in error in stating that there was no evidence supporting the conclusions of the Master that the defendant had tried to conceal material evidence in respect to this accounting, which might have helped the Master in the matter of this accounting. At page 439 of the record, Mr. Layman,
who was particularly conversant with all of the affairs of the
820 defendant company during all of the time of the accounting, was asked by the complainant's counsel whether or not he was in position to ascertain from the books from which the transcript of the account was made, or otherwise, the cost of manufacturing the transformers covered by the report. This is question 113 at page 439 of the record, and his answer is that he could only determine

by reference to the books of the company for the period covered by the record. The examination was then continued and adjourned in order that Mr. Layman might get the data. Then, at page 442, at the next meeting, Mr. Layman was further asked in regard to the matter, and he states in answer to Q. 130, at the top of page 442, that he has not been able to prepare such a report because the books of the company do not give the information asked for, and that the best he is able to submit is a statement as to the total sales of all kinds of apparatus and the total profits for a corresponding period, thus avoiding giving us any information as to the costs, and only being able to give us information as to the sales and as to total profits. Afterwards, when Johannesen and Foster are examined it appears that it had been the regular custom of the defendant company to keep a detailed account of the expenses entering into the manufacture of each of the infringing transformers during the period of time covered by the accounting. Samples of these are shown at pages 726 and 728 of the record, having been identified by the witnesses Johannesen and Foster. Then, on cross-examination by us at pages 652 and 653 of the record, at a very much later stage in the taking of the testimony before the Master, Mr. Layman in the meantime having been put on as a witness for the defendant, Mr. Layman shows that certain records which would have been of material assistance had been destroyed about six years prior to the time when he gave his testimony, which would correspond almost exactly with the final decision in the Carbide case; but it is well to note that he says that those records were destroyed.

It also appears from pages 615 and 616 of the record that when Mr. Layman was being examined by the defendant's counsel he not only admits that it had been the custom, but was the practice, of the defendant company to keep inventories of the cost of manufacture, etc., of the infringing transformers, thus corroborating the testimony of Johannesen and Foster, witnesses introduced on behalf of the complainant on the accounting, but he admits at the foot of page 615 and top of page 616 that he at least thinks those inventories are available, though defendant had a chance to produce
821 them but never did so. This testimony, we respectfully submit, is hardly in harmony with the testimony of Mr. Layman found at pages 439 and 442 of the record; whereas, as appears from page- 652 and 653 of the record it certainly does appear that at a very convenient time, and when there was an immediate prospect of a suit which would result in an accounting by the Wagner Company, records which might have thrown a great deal of light on the subject were destroyed by the defendant company, as Mr. Layman distinctly states.

Taking these matters (which are only some of the things showing concealment and lack of candor on the part of those most intimately acquainted with the business of the defendant company, to say nothing of the fact that all this testimony was taken before the Master who had an opportunity to see the witnesses and notice their behavior) into consideration in connection with the strenuous attempt made by the defendant's counsel, at the very outset of the tak-

ing of the testimony before the Master, to prevent proper investigation as to the defendant's books, we respectfully submit that there was at least some evidence "tending to show" bad faith on the part of the defendant, or at least an attempt to conceal the facts which it was the duty of the Master to ascertaain. Therefore the Master was warranted in his findings in this respect.

It is clear, we earnestly and respectfully submit, that, for the reasons pointed out and fully discussed in this petition, the majority of the court is in error:

(1) In not finding type M transformer an infringement of claim 4 of the patent in suit, and

(2) In not finding the complainant entitled to profits on the infringing transformers accounted for before the Master.

Having, at great pains, undertaken to point out how and in what respects, in its premises and consequently in its conclusions, the majority of the court came to make these errors, we confidently hope and sincerely trust that our petition for a rehearing may be granted, that thus justice may be done. As the majority opinion of this court now stands, we are convinced that it sets up a dangerous precedent on the question of infringement and also on the question of recovery of profits, and one which is out of harmony and in conflict with earlier decisions of this court as well as decisions of
822 the Supreme Court of the United States and of United States Courts of Appeals in other circuits.

Respectfully submitted,

THOMAS B. KERR,
PAUL BAKEWELL,
Solicitors for Westinghouse Electric & Mfg. Co., Petitioner.

I certify that in my opinion this petition for rehearing is well founded, in fact as well as in law.

PAUL BAKEWELL,
Solicitor for Westinghouse Electric & Mfg. Co., Petitioner.

St. Louis, Mo., September 29, 1909.

(Endorsed): Filed Sept. 29, 1909. John D. Jordan, Clerk.

823 (*Order Denying Petition for a Rehearing.*)

And on the eighteenth day of October, A. D. 1909, in the record of the proceedings of said Circuit Court of Appeals is an order denying the petition of appellant for a rehearing in said cause, in the words and figures following, to-wit:

United States Circuit Court of Appeals, Eighth Circuit, September Term, 1909.

No. 2857.

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, Appellant,
vs.
WAGNER ELECTRIC AND MANUFACTURING COMPANY.

Appeal from the Circuit Court of the United States for the Eastern District of Missouri.

MONDAY, *October* 18, 1909.

This cause came on this day to be heard upon the petition for a rehearing, filed by Counsel for Appellant.

On Consideration Whereof, it is now here ordered by this Court, that said petition for a rehearing of this cause, be, and the same is hereby, denied.

October 18, 1909.

(*Motion and Affidavit for Order Staying Mandate.*)

And on the twenty-eighth day of October, A. D. 1909, a motion and affidavit for an order staying the mandate was filed in said cause, in the words and figures following, to-wit:

United States Circuit Court of Appeals, Eighth Circuit.

No. 2857.

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, Appellant.
vs.
WAGNER ELECTRIC AND MANUFACTURING COMPANY, Appellee.

Appeal from the Circuit Court of the United States for the Eastern District of Missouri.

824 Motion of Westinghouse Electric and Manufacturing Company, Appellant, to stay the Issuance of the Mandate of this Court to the United States Circuit Court for the Eastern Division of the Eastern Judicial District of Missouri, Pending a Petition to the Supreme Court of the United States, on Behalf of said Westinghouse Electric and Manufacturing Company, to have the Record in this case Certified to the Supreme Court of the United States for Review and Determination by the Supreme Court of the United States of the Matters Decided by the Majority Opinion of this Court in its Opinion Filed August 16, 1909.

Now comes Westinghouse Electric and Manufacturing Company, Appellant in the above-entitled cause, and respectfully states and moves this honorable Court as follows:

Heretofore, to-wit, on the 16th day of August, 1909, this Court filed a majority opinion holding:

(*a*) That "Type M" transformer does not infringe claim 4 of Appellant's patent, being United States letters patent No. 366,362, dated July 12, 1887, issued to George Westinghouse, Jr., and by him assigned to the Appellant;

(*b*) That the Appellant is entitled to nominal damages only on account of the infringing transformers accounted for before the Master.

Thereafter, to wit, on September 29, 1909, said Westinghouse Electric and Manufacturing Company, Appellant, petitioned this Court for a rehearing in respect to said matters decided by the majority opinion of this Court.

On Monday, October 25, 1909, Appellant's solicitor received word at St. Louis from Mr. John D. Jordan, Clerk of this Court, in the form of a letter dated at St. Paul, Minnesota, October 22, 1909, that on October 18, 1909, an order had been entered by this Court denying Appellant's said petition for rehearing.

Appellant now desires to state to this Court, through its solicitors and counsel, that believing that said decision of the majority of this Court, especially as to the question of the accounting feature of this case, is contrary to certain leading and controlling decisions of the Supreme Court of the United States in analogous cases, and also on account of the gravity and importance of the questions
825 arising on the record in this case, as well as to secure uniformity of decision, Appellant's solicitors are now engaged in preparing a petition for certiorari to the Supreme Court of the United States asking said Court to cause the record and exhibits in this cause to be sent up to it for review, and that it is the intention of the Appellant and its solicitors to file the said petition for certiorari in the Supreme Court of the United States, in conformity with the rules of practice of that court, as speedily as possible.

Therefore, said Westinghouse Electric and Manufacturing Company, Appellant, respectfully moves this honorable Court to stay the issuance of the mandate to the Circuit Court of the United States for the Eastern Division of the Eastern Judicial District of Missouri (which mandate, Appellant's solicitors and counsel are informed, has not yet been issued by this Court) until the further order of this Court, or at least until this Appellant, through its solicitors, may present its said petition for certiorari to the Supreme Court of the United States, and in any event for at least thirty days from the date of the filing of this motion; or for such order in the premises as this Court may deem just and proper.

WESTINGHOUSE ELECTRIC AND
MANUFACTURING CO.,
By THOMAS B. KERR &
PAUL BAKEWELL,
Its Solicitors and Counsel.

STATE OF MISSOURI,
City of St. Louis ss:

Paul Bakewell, being first duly sworn, on his oath says:

I am one of the solicitors and counsel for the Westinghouse Electric and Manufacturing Company, Appellant, in the above-entitled case. The facts as stated in this motion for stay of the issuance of the mandate of this Court to the Circuit Court of the United States for the Eastern Division of the Eastern Judicial District of Missouri are true. The first notice that I had that the petition for rehearing in this case had been denied was in the
826 form of a letter from St. Paul dated October 22, 1909, from the Clerk of the United States Court of Appeals, which I received at my office at St. Louis, Missouri, on Monday, October 25, 1909. Under instructions from Thomas B. Kerr, Esq., of New York City, N. Y., one of the solicitors and counsel of record for the Westinghouse Electric and Manufacturing Company, Appellant, I am now engaged with him in preparing the petition for certiorari to the Supreme Court of the United States referred to in this motion, and it is my intention, in good faith, to prepare the said petition for certiorari and present it to the Supreme Court of the United States, in accordance with the rules of practice provided in such cases, co-operating in that respect with the said Thomas B. Kerr, as speedily as possible; and I state that this motion to this Court is made in the utmost good faith, in the belief that Appellant has good grounds for making said petition for certiorari to the Supreme Court of the United States.

PAUL BAKEWELL.

Sworn to and subscribed before me, this 26th day of October, 1909.

[SEAL.] GEORGE BAKEWELL,
Notary Public.

My term expires February 5, 1913.

(Endorsed:) No. 2857. Westinghouse Electric and Manufacturing Co., Appellant, vs. Wagner Electric and Manufacturing Co. Motion and Affidavit for order staying mandate. Filed Oct. 28, 1909. John D. Jordan, Clerk.

(Order Staying Mandate for Sixty Days from October 28, 1909.)

And on the twenty-eighth day of October, A. D. 1909, in the record of the proceedings of said Circuit Court of Appeals is an order staying the issuance of the mandate for sixty days from October 28, 1909, in said cause, in the words and figures following, to-wit:

827 United States Circuit Court of Appeals, Eighth Circuit, September Term, 1909.

No. 2857.

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, Appellant,
vs.
WAGNER ELECTRIC AND MANUFACTURING COMPANY.

Appeal from the Circuit Court of the United States for the Eastern District of Missouri.

THURSDAY, *October* 28, 1909.

Upon consideration of the motion of the Appellant in the above entitled cause, it is now here ordered that the mandate in this cause be, and the same is hereby, stayed for a period of Sixty days from and after this date, pending the presentation to and disposition by the Supreme Court of the United States of an application by said Appellant for a writ of certiorari herein.

October 28, 1909.

828 *(Clerk's Certificate.)*

United States Circuit Court of Appeals, Eighth Circuit.

I, John D. Jordan, Clerk of the United States Circuit Court of Appeals for the Eighth Circuit, do hereby certify that the foregoing transcript contains full, true and complete copies of all the pleadings, record entries and proceedings, including the opinion of said United States Circuit Court of Appeals for the Eighth Circuit (except the transcript of the record from the Circuit Court of the United States for the Eastern District of Missouri), in a certain cause in said Court wherein the Westinghouse Electric and Manufacturing Company is Appellant and the Wagner Electric and Manufacturing Company is Appellee, No. 2857, as full, true and complete as the originals of the same remain on file and record in my office.

In Testimony Whereof, I hereunto subscribe my name and affix the seal of the United States Circuit Court of Appeals for the Eighth Circuit, at office in the City of St. Louis, Missouri, this twenty-fourth day of November, A. D. 1909.

[Seal United States Circuit Court of Appeals, Eighth Circuit.]

JOHN D. JORDAN,
Clerk of the United States Circuit Court of Appeals for the Eighth Circuit.

829 United States Circuit Court of Appeals, Eighth Circuit.

No. 2857.

WESTINGHOUSE ELECTRIC & MANUFACTURING CO., Appellant,
vs.
WAGNER ELECTRIC MANUFACTURING CO., Appellee.

Stipulation as to Clerk's Return to Writ of Certiorari.

It is hereby stipulated and agreed by and between the parties hereto that the certified copy of the entire record in the above-entitled cause in the United States Circuit Court of Appeals for the Eighth Circuit, which was filed by the above-named Appellant in the Supreme Court of the United States with its petition to said Supreme Court for a writ of certiorari, requiring the cause to be certified to said Supreme Court for its review and determination, shall be taken as a return to the writ of certiorari issued by the Supreme Court of the United States on January 19, 1910, upon the application of the above-named Appellant.

And the Clerk of the said United States Circuit Court of Appeals for the Eighth Circuit is hereby requested to send up to the said Supreme Court of the United States a copy of this stipulation as his return to the writ of certiorari in lieu of a certified transcript of the record in said cause.

PAUL BAKEWELL,
Solicitor and of Counsel for Westinghouse Electric & Mfg. Co., Appellant.
A. C. FOWLER,
Solicitor and of Counsel for Wagner Mfg. Co., Appellee.

St. Louis, January 22, 1910.

(Endorsed:) U. S. Circuit Court of Appeals, Eighth Circuit. In Equity. No. 2857. Westinghouse Electric, &c., Co. vs. Wagner Co. Stipulation as to Clerk's return to Writ of Certiorari. Filed Jan. 22, 1910. John D. Jordan, Clerk.

830 UNITED STATES OF AMERICA, ss:

The President of the United States of America to the Honorable Judges of the United States Circuit Court of Appeals for the Eighth Circuit, Greeting:

[Seal of the Supreme Court of the United States.]

Being informed that there is now pending before you a suit in which Westinghouse Electric & Manufacturing Company is appellant, and Wagner Electric Manufacturing Company is appellee, which suit was removed into the said Circuit Court of Appeals by virtue of an appeal from the Circuit Court of the United States for the

Eastern District of Missouri, and we, being willing for certain reasons that the said cause and the record and proceedings therein should be certified by the said Circuit Court of Appeals and
831 removed into the Supreme Court of the United States, do hereby command you that you send without delay to the said Supreme Court, as aforesaid, the record and proceedings in said cause, so that the said Supreme Court may act thereon as of right and according to law ought to be done.

Witness the Honorable Melville W. Fuller, Chief Justice of the United States, the 19th day of January, in the year of our Lord one thousand nine hundred and ten.

JAMES H. McKENNEY,
Clerk of the Supreme Court of the United States.

832 *Return to Writ.*

UNITED STATES OF AMERICA,
Eighth Circuit, ss:

In obedience to the command of the within writ of certiorari and in pursuance of the stipulation of the parties, a full, true and complete copy of which is hereto attached, I hereby certify that the transcript of record furnished with the application for a writ of certiorari in the case of Westinghouse Electric and Manufacturing Company, Appellant, vs. Wagner Electric and Manufacturing Company, is a full, true and complete transcript with all the pleadings, proceedings and record entries in said cause as mentioned in the certificates thereto.

In Testimony Whereof, I hereunto subscribe my name and affix the seal of the United States Circuit Court of Appeals for the Eighth Circuit, at office in the city of St. Louis, Missouri, this twenty-seventh day of January, A. D. 1910.

[Seal United States Circuit Court of Appeals, Eighth Circuit.]

JOHN D. JORDAN,
Clerk of the United States Circuit Court of Appeals for the Eighth Circuit.

[Endorsed:] File No. 21,945. Supreme Court of the United States. No. 719, October Term, 1909. Westinghouse Electric & Mfg. Co. vs. Wagner Electric Manufacturing Co. Writ of Certiorari. Filed Jan. 22, 1910. John D. Jordan, Clerk.

833 [Endorsed:] File No. 21,945. Supreme Court U. S. October Term, 1910. Term No. 179. Westinghouse Electric & Mfg. Co., Petitioner, vs. Wagner Electric Manufacturing Co. Writ of certiorari and return. Filed January 29, 1910.